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PC MAGAZINE

VOLUME 7 NUMBER 10
MAY 31, 1988

Hard Disk Disaster: Prepare Now!

Save Your Data

- 18 Easier-than-Ever Backup Programs
- 13 Brand-new Tape Drives for PS/2

- VGA Rising—15 Sharp (And Not-So-Sharp) VGA Monitors
- 8 Serious Color Printers: They're Not Toys Anymore
- TOPS—Mac Simple, PC Smart

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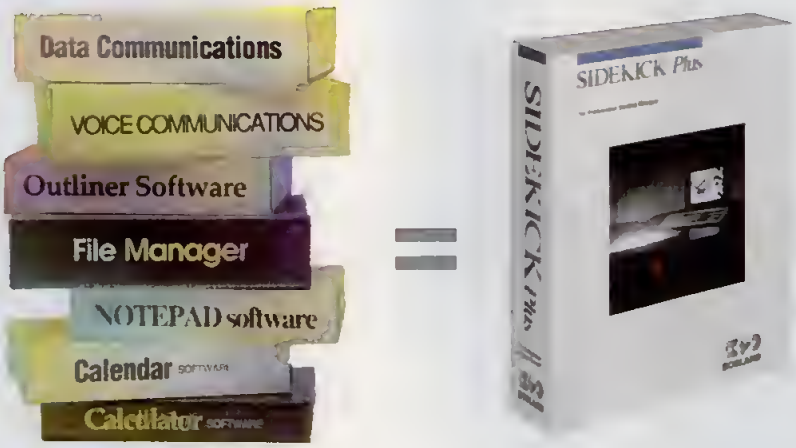

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Wait State	Zero	Zero	Zero, Norton V3 SI rating: 15.3
RAM	1MB static column	1MB static column	512K DRAM (80ns)
On Board Expansion Memory	Up to 4MB	Up to 4MB	Up to 4MB
System Expansion Memory	Up to 12MB	Up to 12MB	Up to 16MB
Math Co-Processor Support	80287/80387	80287/80387	80287
Controller Card Handles	2 hard disks, 2 floppies	2 hard disks, 2 floppies	1 hard disk, 1 floppy
Disk Drive(s) Included	1.2MB floppy drive	1.2MB floppy drive	20MB hard drive, 1.44MB floppy drive
Clock/Calendar	Yes	Yes	Yes, with 10-year battery life
Ports	2 serial, 1 parallel, joystick adapter	2 serial, 1 parallel, joystick adapter	2 serial, 1 parallel, joystick adapter
Expansion Slots	1 32-bit memory bus, 5 16-bit, 2 8-bit	1 32-bit memory bus, 5 16-bit, 2 8-bit	3 16-bit, 2 8-bit
Keyboard	101-key enhanced	101-key enhanced	86-key
Power Supply (watts)	200	200	200
Reset Switch	Yes	Yes	Yes, with 2-second safety delay
BIOS	Award 32-bit ROM	Award 32-bit ROM	Phoenix
Warranty	1 year	1 year	1 year
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System Expansion Memory	Up to 16MB	Up to 16MB	Up to 8MB EMS
Math Co-Processor Support	80287	80287	8087
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Clock/Calendar	Yes, with 10-year battery life	Yes, with 10-year battery life	Yes
Ports	2 serial, 1 parallel, joystick adapter	2 serial, 1 parallel, joystick adapter	1 serial, 2 parallel, game port
Expansion Slots	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	8 8-bit
Keyboard	101-key enhanced	101-key enhanced	84-key standard
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VOLUME 7 NUMBER 10

WHAT'S INSIDE

Five years is a long time in the magazine business. We've seen the PC marketplace grow from an exciting upstart to a major economic force. Change is part of our daily diet. One of the constants on *PC Magazine*, however, has been executive editor Paul Somerson. From his early days as our special projects editor, Paul has been an integral part of *PC Magazine*'s design, execution, and success.

Rites of passage: executive editor Gus Venditto, senior editor Nora Georgas, and departing executive editor Paul Somerson.

As we close this issue, we bid farewell to Paul, whose acerbic wit, passion for quality, and impressive technical knowledge will be sorely missed. But we can't be too downhearted: Paul is leaving us to father a new Ziff-Davis publication, *PC Computing*. Based in our East Coast headquarters in Boston, *PC Computing* will give new computer users the information they need to choose products and to get the most out of them—and will do it in a literate, lively, and entertaining way that's guaranteed to turn heads. You'll want to recommend *PC Computing* to your coworkers and friends who enjoy computing but don't need the technical articles and benchmark testing found here in *PC Magazine*. Look for the first issue in August.

DUELING DEADLINES With Paul trading in his city shoes for Bass Weejuns, changes are afoot at *PC Magazine*. Gus Venditto, former don of the First Looks and After Hours sections, takes Paul's place as executive editor with overall responsibility for all the departments. PC MagNet, our exciting new project that puts readers on-line to *PC Magazine* and replaces the Interactive Reader Service, also falls under his wing. See First Looks in this issue for details.

And who takes Gus's place? Well, as Nora Georgas finished editing features for the May 31 issue, she was also starting First Looks for the May 17 issue. Sound like a time warp crossed with a pressure cooker? She also picks up Gus's responsibility for the day-to-day operation of After Hours and our wonderfully opinionated Viewpoints columnists. The deadlines won't seem quite so manic once she's done it for a while, but for now, Nora can't help paraphrasing Kermit the Frog: "It isn't easy being Gus. But," she adds, "it sure is fun."

Special thanks this issue to art director Mary Zisk, who braved fire and fumes to create our sizzling cover photo. By the time you read this, she should have the smell of burning plastic out of most of her clothes. And don't worry—we didn't use a working hard disk for the photo. Our model had already bitten the dust—a clear call for good backup practices. PC

Photograph: Thom O'Connor

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PC MAGAZINE

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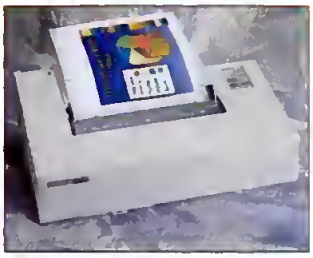

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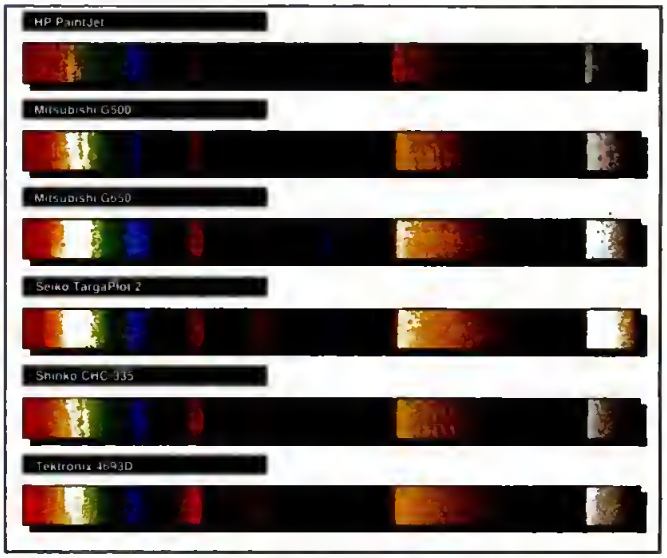

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Speed figures are consolidated results from 10 tests of CPU performance (See Accelerator Boards Special Report, December 1, 1986.)

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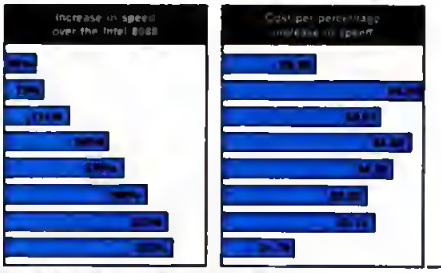
☐ Microsoft Mach 10	$395
☐ Univation Dream Board	$512
☐ Orchid Turbo EGA	$945
☐ ST&D Standard 286	$995
☐ Classic Speedpack	$995
☐ Orchid PC-Turbo 286e	$1,195
☐ **Breakthru 286-12**	**$595**



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Breakthru 286-12MHz-$595

LIGHTNING™—FREE with Breakthru speedup hardware—$89.95 purchased separately

We are excited about our three speedup products. You probably know about our Lightning disk access speedup software that was awarded PC Magazine's Best of 1986 award (see box). After the smashing success of Lightning, in late '86, we guaranteed the Breakthru 286 board to be literally the most advanced, fastest, most feature-rich board available. The runaway success it has enjoyed truly proved that assertion. Now we go ourselves one better with the Breakthru 286-12. This new board has the clock speed cranked up from 8 to 12 MHz for speeds up to 10.2 times faster than an IBM PC. It is 50% faster than an 8MHz IBM AT, and up to a whopping 1,000% faster than a regular PC.

But, no speedup board cuts disk access time in half

LIGHTNING

software can - $89.95 or FREE w/Breakthru

"Lightning is almost mandatory...." -
Steve Manes, PC Magazine
Best of 86 review

Loads with the DOS - always ready as a background program to accelerate disk access. You do nothing - everything is automatic. Programs that frequently access the disk (hard or floppy) are made instantly up to 2 to 4 times faster. Uses a principle greatly enhanced from mainframe technology called caching. Fully exploits Above Board memory.

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PC MAGAZINE EDITORS' CHOICE BEST 1986

HERE'S WHY THESE TWO BOARDS ARE SO SPECIAL.

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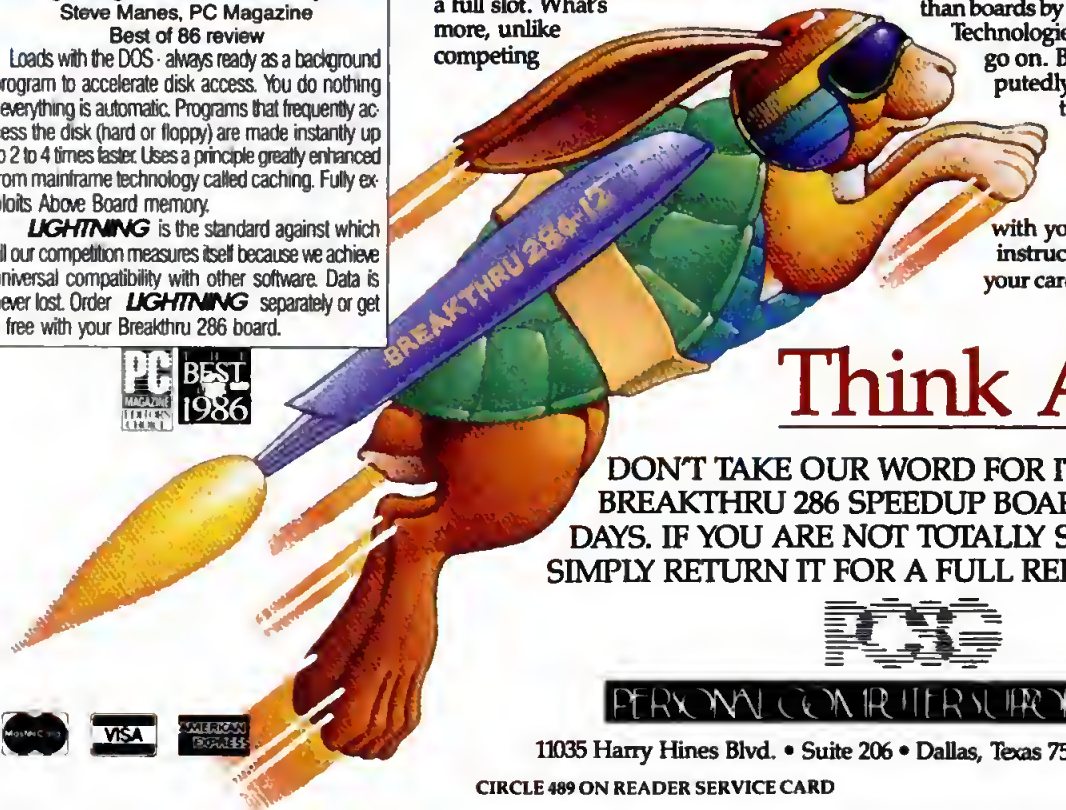
Third, you have full compatibility. All existing system RAM, hardware, and peripheral cards can be used without software modification. Our boards operate with LAN and mainframe communication products and conform to the Expanded Memory Specification (EMS). Software compatibility is virtually universal.

Faster and smarter than an AT - PCSG guarantees it.

Fourth, these are the best. There are several other boards on the speedup market. We at PCSG have compared them all, but there simply is no comparison. Many cards offer only a marginal speedup in spite of their claims and others are just poorly engineered.

We are really excited about these products. PCSG makes the unabashed statement that the BREAKTHRU 286 card represents more advanced technology than boards by Orchid, Quadram, P.C. Technologies, Phoenix...we could go on. Breakthru 286 is undisputedly the turbo board with the biggest bang for the buck. And we include FREE the $89.95 acclaimed Lightning software. Call today with your credit card or COD instructions and we will ship your card the very next day.



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Don't take our word for it. Use Lucid 3-D for 60 days. Return it for a full refund if not completely satisfied. Plus, instead of the $199 list price, an introductory spread-the-word price of $149.

Lucid 3-D is priced to sell at $199, but we want thousands of people using Lucid everyday, all over the world. We invite you to be a part of that group. The reason we are offering Lucid for only $149, on a sixty day return for a full refund, is simple. Preliminary user testing of the product produces the same results over and over. People tell us they would never work without Lucid 3-D again. Even folks continuing to work with 1-2-3.

Memory Resident

That's because the idea of a memory resident spreadsheet makes sense, one that you can pop-up instantly while working in your word processor or any other program. Lucid lets you cut anything on the screen and paste it right into Lucid, or cut anything from a Lucid worksheet and paste into the application below. You can even run Lucid on top of 1-2-3 if you like, and cut and paste information from one to the other, including formulas.

Lucid 3-D was developed over the past two years with countless, exhaustive hours of planning and programming to produce something spectacular. This is a product that works the way we dreamed a spreadsheet would function. Everyone who has seen it says things like, "*Lucid 3-D is how software of the 1990's will look and perform*", or even more to the point "*This is the way I thought a computer should work*". You'll see, Lucid is exciting.

FIG. 2 Here we are, instantly. Notice the lower left corner showing we are on level 2. You can go down or up. (See next page)

FIG. 1 Let's get the detail on those ad costs. Just move the widebar to that cell and press one key (grey +).

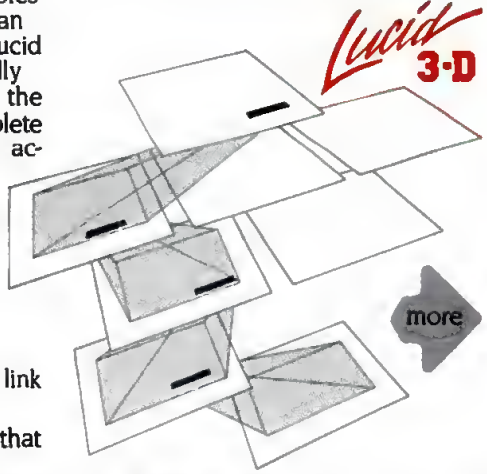
way. Users say "*It is so intuitive that I really don't need a manual.*" That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said that, "*If there ever was an interface idea so good it ought to be stolen and widely used, this is it.*"

What he was talking about is a new menu approach that follows a simple design concept: it is easier to recognize than it is to remember. As choices are made on a menu that take you to lower levels you always can see exactly where you came from and where you are going. The complete menu path is always visible. You cannot get lost several levels down. This means you never have to remember a command, you just flow right to it.

What Makes it so Special

In the screen examples you can see Lucid is really multi-dimensional. Any cell of the spreadsheet can contain a complete other spreadsheet that you can access with a single keystroke. It is as simple as the pictures show. And you don't have to write formulas to do that. All you do is go look at the other file, navigating through easy, point and shoot directories. When you come back up (with one key) the link is made automatically for you.

Everything about Lucid works that



Any cell can contain a complete other spreadsheet that you can access with a single key.

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 400 topics and select the one you want.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.

FIG. 3 We want more detail, so let's go to Newspapers. Just press the Grey + Key

FIG. 4. Now, instantly we are on level 3. Each level is a different spreadsheet. You could now move to the New York Times and see the detail on that figure. There is no limit to the levels you can go. Move right down to transaction level if you like.

> "The best idea I've seen for a spreadsheet in years."
>
> Jim Seymour, Columnist, PC Magazine, PC Week

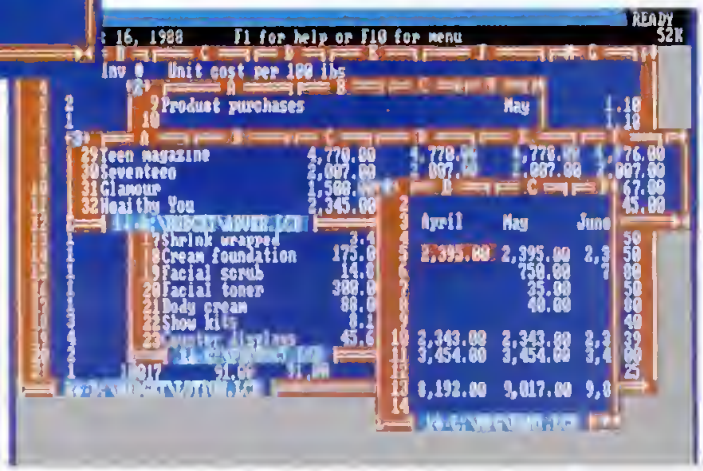


Fig. 5. Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many as 3-D levels as you like. No one else can do that.

Speed

Lucid 3-D is truly revolutionary. It is fast, fast, fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing screen are completed. Other calculations you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about.

Lucid Learns

Lucid 3-D also lets you teach it any combinations of keystrokes so that involved sequences can be done with single keys. Plus more than just remembering keystrokes, Lucid allows you to create Macros with loops, procedures and conditional branching amazingly all done automatically with simple menus. You can create your own menus that show the new features you have taught it. Another great feature is you can make your custom menus work like Lucid where one choice can take you down a level to a whole new set of choices. What's nice is that they will work from one spreadsheet to another.

Mouseability

Lucid 3-D was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those you've seen with 1-2-3.

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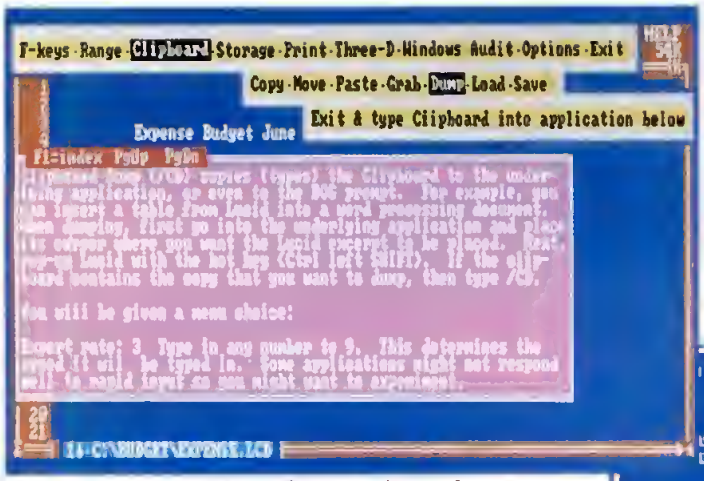

FIG. 6 We need those budget figures in the Word Perfect letter we are writing. Clipboard Dump does it right now.

FIG. 7 Here it is right in Word Perfect (or any word processor) just like you typed it. You can go the other way just as easily.

A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often.

It really permits that feeling of becoming one with your work. Lucid 3-D has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

Audit

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid offers five audit displays and printouts.

Masterwork

We could go on at great length about all the features and innovations in Lucid, but Lucid is more than a bag of features. What is most important is the pride and craftsmanship that went into its creation. It is a masterwork. The overall feel is tight and polished. In fact, Paul Somerson, executive editor of PC *Magazine*, used one word to describe it, "*Slick*".

PCSG has built a reputation as a development laboratory producing products that you know are excellent. In 1983 PCSG dominated the Model 100 laptop market with ROM based software that every reviewer rated as excellent. In 1985 we produced ***LIGHTNING*** the pioneer and award winning Disk speed up software. In 1986 we developed the ***BREAKthru 286*** accelerator board that blew everything else out of the water, and later we topped ourselves with the Breakthru 12. Now in 1987 those who have worked with Lucid 3-D tell us "*you have done it again. This is software everyone should have.*"

Even if you don't plan to abandon 1-2-3, Lucid makes sense. Files are converted between them with ease so there's not an interoffice compatibility problem. This means you can have the power and fun of Lucid 3-D without having to upset your present systems.

We are excited about Lucid 3-D. But don't take our word for it, take us up on our 60 day offer. Call us on our order line number and we will ship your order the very next day. This $149 offer will end as soon as our dealer network is fully stocked. But in the mean time we invite you to try Lucid as part of our "spread the news" campaign. Just pick up the phone and call us. We accept all major credit cards or you can order COD.

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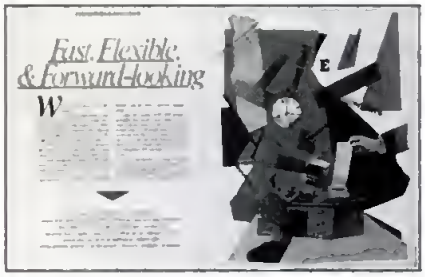
LETTERS TO PC MAGAZINE

55 WORD PROCESSORS

I would like to commend the *PC Magazine* staff for the excellent comments on all the word processing packages reviewed ("Fast, Flexible, and Forward-looking," *PC Magazine*, February 29, 1988). The reviews were refreshingly unbiased and



very informative. The time spent reviewing each product was greatly appreciated and helped me to choose a product that my pocket could handle and that delivers the features I need.

Carl E. Schiavoni, Jr.
Wilmington, Delaware

Your review of *PractiWord* states that you called Practicorp International's technical support daily for 3 days before they returned your call ("Fast, Flexible, and Forward-looking"). How did you get so lucky? I am still waiting for a reply from Practicorp on Version 1.06 of *PractiWord* after having called and written repeatedly in 1986! Evidently, I do not own, nor do I intend to own, Version 1.09.

Yves M. Rotblit
Great Neck, New York

The problem with your word processor reviews is that they are written for publication in your magazine ("Fast, Flexible, and Forward-looking"). Your reviewers throw a sheet of electronic paper into a machine and type away until they finish. Then you pay someone else to format their text and make it look good in print. In other words, your writers have no need for *MultiMate*'s page orientation. In fact, they complain about it constantly.

If your reviews influence Ashton-Tate and *MultiMate* starts cluttering up the screen and reformatting my pages automatically—a feature your writers love—I may go out and kill someone. The world does not need another *WordPerfect* clone.

Joseph T. Rigo
New York, New York

I was very impressed by your reviews of the 55 word processors ("Fast, Flexible, and Forward-looking"). The entire report, which was both interesting and informative, helped me to understand many of the technical aspects of word processing.

Jay Benach
Mt. Kisco, New York

I studied with great interest your excellent reviews of word processors ("Fast, Flexible, and Forward-looking"). With regard to the review of *MASS-11*, I would like to note that Frank Bican, your reviewer, apparently tested far more features in *MASS-11* than I have had occasion to use. For this I congratulate him.

Casper F. Cowan
Portland, Maine

In Carol Olsen Day's review of *Textra*, she suggests that you cannot exit a document without saving your edits except by going to DOS ("Fast, Flexible, and Forward-looking"). This statement is incorrect; the procedure to exit without saving edits is F1-F10 or Shift-F10 (to get to the save menu), and then F4 (which exits the document without a save). I would like to note, however, that Ms. Day's review of *Textra* is otherwise excellent, especially in her recognition of its two key features—speed and ease of use.

James B. Boskey
Newark, New Jersey

SYSINFO TO THE TEST

As is the norm for *PC Magazine*, your reviews of AT compatibles were both highly informative and opportune ("The Cheapest ATs Ever," *PC Magazine*, February 16, 1988). However, I do have one question for the PC Labs staff. Many computer manufacturers boldly state how their machines rate on *The Norton Utilities* SysInfo check. How do *Norton*'s figures relate to the speed figures obtained from your benchmark tests, which provide both speed of execution and speed relative to a standard IBM 4.77-MHz PC and an IBM PC AT? Does SysInfo test the same items tested by the benchmarks, or are the two sets of figures completely unrelated?

Dana R. Harknett
San Angelo, Texas

Norton's SysInfo was originally intended to show how many times faster than a PC-XT a machine was. The 80286 and other chips with prefetch queues rendered it nonlinear and rather useless for comparison. PC Labs tests look at many different functions. The NOP test is purely analogous to processor clock speed, while the Instruction Mix tests come closest to representing how application

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- ☐ **SIMULATION 1**—Maze making program, MIT's Life simulation, starfields, etc. Color graphics req.
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PC-5/31/88

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- [2] **CAD 1a,b**—(2 disks) Fingerpaint 1.2 advanced painting and Altamire object oriented design. Color.
- [2] **CAD 2a,b**—(2 disks) DanCad3d, an advanced 2D/3D drafting program w/animation. 640K, color.
- [2] **COMM 2a,b**—(2 disks) Procomm 2.42, an excellent modem program with terminal emulation.
- ☐ **EDUCATION 3**—PC-Fastype 1.20 typing tutor, ideal for beginners and advanced students alike.
- [2] **FINANCES 3a,b**—(2 disks) Express Calc 3.12, a powerful and user friendly spreadsheet program.
- ☐ **GAMES 8**—Striker helicopter attack and Risk, the game of world domination. Color required.
- ☐ **GAMES 12**—Backgammon (play the computer) and Wheel of Fortune based on the gameshow.
- ☐ **GRAPHICS 1**—Record and play back screen images! Excellent for demo, etc. Color required.
- [3] **GRAPHICS 2a,b,c**—(3 disks) An excellent 3-D surface modelling and shading program. Color.
- [2] **INFO 2a,b**—(2 disks) Zip-Phone, national areacode/prefix to zip-code cross reference.
- [2] **LANGUAGE 3a,b**—(2 disks) The A86 3.09 macro assembler and debugger for 8088/86/286s.
- [2] **SHELL 4a,b**—(2 disks) Automenu and HDM II 4.04 hard disk prog. for custom full-screen menus.
- ☐ **UTILITIES 5**—Hard disk utilities for verifying, formatting, parking and optimizing your disk drives.
- ☐ **UTILITIES 6**—Advanced utilities including Mark/Release (remove resident progs w/o reboot!)
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- [2] **WORD 1a,b**—(2 disks) PC Write 2.71, a powerful word processing system w/spell checker, laser supt.

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■ LETTERS

programs will perform. Note that we use different instruction mixes for the 8088, 80286, and 80386.—Ed.

THE NERVE OF WORD

Is anybody else annoyed at the way Microsoft names its products? Why do they always have to be prefaced by the company name? In your review of word processing programs ("Fast, Flexible, and Forward-looking"), *Word* had to be alphabetically listed under "M" for *Microsoft Word*. Why wasn't *WordStar* listed under "M" for *MicroPro WordStar?*

I wonder what Microsoft will name their next product. Wouldn't it be real wild if they picked something so simple, like "*Generic*"? Then, in order to make sure nobody thought we were talking about grocery-store generic in the course of a conversation, we could worshipfully scream out "*Microsoft Generic*" and give a plug not just to our favorite program, but to the whole company.

Tom Vis
Reston, Virginia

IN DEFENSE OF XYWRITE

Your recent issue comparing word processors was terrific ("Fast, Flexible, and Forward-looking"). It was comprehensive, balanced, and certainly detailed enough for any taste.

The time has come, however, to debunk the myth that *XyWrite* is difficult to learn. In every review I have seen, the author always notes this apparent "fact" before continuing to write of the program's speed and power.

I picked up *XyWrite* about 4 months ago and found it easy to understand. *XyWrite* has a natural, intuitive structure and was the first word processor I had ever used that really felt comfortable. So, enough of this "hard to learn" business. Folks, it really isn't so!

Dan Ehrmann
Chicago, Illinois

I'm glad to see *XyWrite III Plus* is finally getting its due in print ("Fast, Flexible, and Forward-looking"). I am one of its ardent followers, and with good reason. Kudos to *PC Magazine* for recognizing this little-known word processor as the giant it really is! Look out *Word, WordPerfect,* and *WordStar; XyWrite* is on the same track and gaining steam.

■ Kudos for recognizing *XyWrite* as the giant it really is! Look out *WordPerfect, Word,* and *WordStar; XyWrite* is on the same track and gaining steam.

Stephen A. Risik
York, Pennsylvania

Although I'm not one to send letters to the editor, I must point out what I consider to be a cheap shot at XyQuest taken by someone on your staff ("Fast, Flexible, and Forward-looking"). The cheap shot is the comment in the Editor's Choice sidebar: "The one dark cloud on *XyWrite*'s horizon is the question of whether this small company has the desire to keep pace with the industry and build a better user interface."

XyQuest has used the same interface since its first version of *XyWrite* in the fall of 1982, when menus were the accepted interface. XyQuest obviously intends to use what it feels is a better interface. The fact that it has chosen that interface does not mean that it doesn't want to keep pace with the leaders.

PC Magazine has been using *XyWrite* for several years, despite, or because of, the interface. If the interface is good enough for you, then why isn't it good for everyone else?

Joseph E. Russell
Oakland, California

PC LABS TO THE TEST

I very much appreciate the valuable service your magazine performs by its extensive testing and reviewing of computer products. Many small firms, like mine, lack the resources to do such testing, but still need product knowledge to assist their

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CIRCLE 515 ON READER SERVICE CARD

Choose the Wrong

"I just assumed..."

These are the three most deadly words in business.

When others hear them, they know what happened.

Someone didn't do his homework.

Someone didn't ask the right questions.

Someone didn't think.

The next operating system you choose will have far-reaching consequences...in terms of cost, compatibility, and connectivity. Make sure your recommendations aren't based on false assumptions.

"Tell me again why our next operating system will cost over $1,000 per computer."

When they tell you that OS/2 will be a low-cost upgrade, don't believe it.

Computerworld's March 7, 1988, front-page story stated that OS/2 could cost "nearly $5,000 in additional expenses" for each IBM PC AT...to cover the costs of memory expansion and a new display.

"Even if you just bought an IBM Personal System/2 Model 50 last week," the report continued, "you are probably looking at extensive upgrade costs..." $1,750 for more memory, alone.

Plus, you'll need to add the costs of new applications software, the costs

Operating System...And You'll Pay.

of training, and the costs of the system.

All in all, a very expensive upgrade.

"How can you say this operating system is compatible...when half our computers can't even run it."

Take a look around at the mix of PCs your company uses.

Think one version of OS/2 can be used as a company standard?

Think again.

Because each brand of 80286 or 80386 PCs or PS/2s needs its own machine-specific version. And each version has its own set of hardware and software compatibilities.

8088-PCs are totally out of the picture, and PC-DOS programs don't run while you're interacting with an OS/2 application.

"So you're telling me that to play it safe, we should use the operating system's network... or use none at all."

Open architecture is what built the business PC industry...because it enables you to mix and match the best software with the best hardware for your specific needs.

Which makes you wonder just how smart it is to install an operating system designed for a specific network... that may or may not be best for you. That may or may not be compatible with the networks you already have.

Our competition wants you to buy it all from them.

We give you a choice.

So we're compatible with the networking standard: Novell.

We take advantage of the fastest software-driven network: LANLink 5X.™

And we work with the standard in micro-to-mainframe connectivity: Irma by DCA.

"What's this I've heard about operating systems designed for multi-user work groups?"

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Because it's multi-user, you can share a PC's data, programs, memory, and processing power with workstations costing under $500, each.

"If PC-MOS can save us over $1,000 per user, why aren't we using it?"

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PC-MOS was designed to be an operating system standard for the mix of 80286 and 80386 PCs in your company. So you don't have to worry about varying levels of compatibility among your PCs.

It's an operating system that provides compatibility with the hardware and software you have. And it provides a migration path to future applications which will take advantage of the 80386 processor's 32-bit mode.

PC-MOS is available for both 80286 and 80386 PCs and PS/2s.

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We Have Designs on Your Computer.

For years PC users have been conditioned to think of their computers in certain terms. Dependable. Versatile. Dull. To get superior graphics, some claimed that you need a different type of computer altogether. They said *their* computer was everything the PC wasn't. Easy to use. Graphically exciting. Fun. PC owners were, well, *green* with MacEnvy.

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■ LETTERS

clients. PC Labs allows many more little guys to make a living in our industry than would otherwise be possible.

Don Pepe
Jacksonville, Florida

NOTES FROM OVERSEAS

As an overseas subscriber for more than 3 years, I would like to commend you on your fine magazine. It is absolute tops in the IBM PC world and a great value.

Gerd Jan de Kruijff
Arnhem, the Netherlands

I am one of your longtime overseas subscribers, and I applaud the high standards and topical relevance of your magazine. The utilities you include in each issue are of great interest to me for their own usefulness as well as for illustrating techniques in assembly language. I usually type in the .ASM listing since a call to your Interactive Reader Service from here would be too expensive!

Max G. Chandivert
Huntingdale, Australia

A DESERVING HAND

Congratulations for using the talents of a human calligrapher on the cover of your February 29, 1988, issue. With all the print enhancement programs, laser printers, and typesetting machines available to *PC Magazine,* you have shown that real people are sometimes better than computers—even for something as mundane as printing text!

David R. Murray
Wilton, Connecticut

TRASH LASH

Many of your editors and columnists, including John C. Dvorak and Bill Machrone, often speak of IBM as if it were trash. I would like to ask them, how did this "trash" become so successful?

In Bill Machrone's editorial "One Million PS/2s" (*PC Magazine,* February 29, 1988), he states that IBM's Models 25 and 30 own two-thirds of the PS/2 market. If this is true, why do you insist on criticizing these computers? Maybe most of the people Mr. Machrone knows would prefer a Compaq 386, but just how many people does he know? Certainly not everybody.

On the other hand, I would like to thank

■ Maybe most of the people Bill Machrone knows prefer a Compaq 386, but just how many people does he know? Certainly not everybody.

Stephen Manes for holding back much of this ridiculous nonsense. If Mr. Manes does not like something, he may show it with his humorous writing, but he would not repeat the same things over and over again.

Christopher Heiser
Canyon Lake, Califomia

CORRECTIONS/AMPLIFICATIONS

The *Allegory* word processor ("Fast, Flexible, and Forward-looking") requires only DOS 2.0 or later. Also, the correct address and phone number is April Software, 429 F St. #9, Davis, CA 95616; (916) 758-8088.

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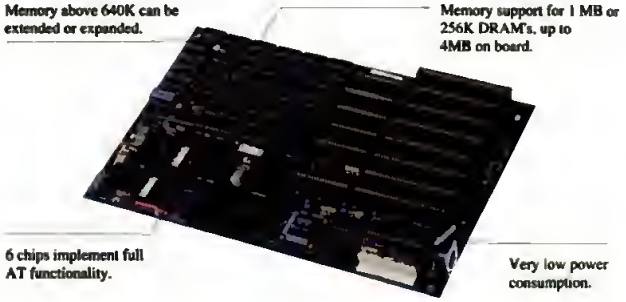

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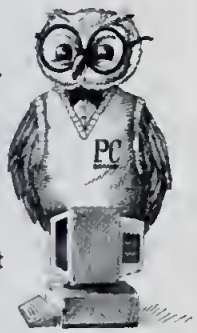

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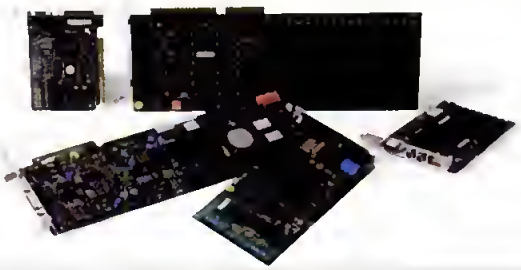

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PAYROLL

- supports manual or computer produced checks
- automatically calculates all federal and state taxes, unemployment and disability insurance
- supports local taxes
- automatically posts payroll expenses to General Ledger and Jobcost
- allows seven income fields including pay advance and tip fields
- deducts for taxable benefits
- automatically retains QTD and YTD employee earnings, deductions and associated payroll expenses
- accumulates 940, 941, W-2 and state tax information
- produces immediate employee reports on screen or printer including W-2 forms, employee mailing labels, payroll journals, QTD and YTD reports of earnings & deductions, and employee record reports.

ACCOUNTS RECEIVABLE

- uses open invoice method to keep track of full or partial payments against any customer invoices
- fully paid invoice may be purged or retained
- automatically updates inventory and ledger accounts, and project records
- user can define aging periods
- reports produced on screen or printer including mailing labels, aged summary, aged detail and receivables journal
- automatically displays customer names and numbers on screen when required for program input
- prints computerized invoices or supports manual invoicing
- prints computerized customer statements with remittance stubs

ACCOUNTS PAYABLE

- uses open invoice method to keep track of full or partial payments against any supplier invoice
- fully paid invoices may be purged or retained
- automatically updates inventory records, project records and ledger accounts
- user can define aging periods
- produces immediate vendor reports on screen or printer including mailing labels, aged summary and details, and payables journal
- automatically displays vendor names and numbers on screen when required for program input
- prints computerized checks or supports entry of manual checks

INVENTORY

- suitable for manufacturers and wholesalers
- handles state sales taxes
- updates from receivables and payables
- uses weighted average cost method
- handles adjustments and transfers
- automatically flags reorder levels
- reports can be displayed, printed or exported
- expresses selling and cost price to three decimals

JOB COST

- any revenue or expense transaction can be allocated to profit centers, divisions or projects
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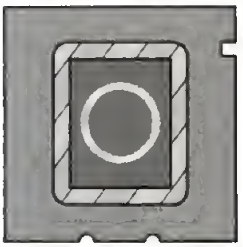

PC ADVISOR

Help in finding a head-parking utility for hard disks, in adding memory to an HP LaserJet series II, and in choosing a low-cost alternative to Lotus 1-2-3.

PARKING HEADS

I'm concerned about my inability to park the heads on my two 20MB Seagate hard drives. I've got to move my computer soon, and I don't want to risk damaging my disk. I'd also feel safer if I could park the heads at the end of each day.

Edward J. Lefkowiez
Fairhaven, Massachusetts

As an amateur programmer, I occasionally find myself in a system lockup when I encounter fatal errors during the debugging stage. I usually have to toggle my system on and off in order to get moving again. I'm worried that having to turn my computer off without parking the disk heads may damage my hard disk. Do you know of any utilities that will park the hard disk if the system locks up?

Paul R. Schiffler
Toledo, Ohio

It's nice to hear that people have gotten the message about head parking. Ensuring that your heads are safely parked before you turn off your system can save you much grief.

Senior technical editor Robert L. Hummel published a simple but excellent head-parking routine in his PC Tutor column in the March 15, 1988, issue of PC Magazine. *The program will allow you to park the heads of two separate disk drives. Robert also went to the trouble of discussing the reasons behind head parking. So even if you don't think you need his program, read what he has to say about disk heads crashing into disk platters. You may decide to try his program after all.*

As for a utility that automatically parks your heads when your system freezes up, dream on. Your system's crashing isn't exactly a planned activity, so there is no way to predict when it will happen. And, of course, once it does happen, your system is dead in the water, unable to execute any program.

You can, however, enlist the services of a timed head-parking utility. Such utilities automatically park the disk heads when there has been no disk activity for a specified period of time. For example, you might set the utility to park the heads each time you haven't accessed the disk for 30 seconds. Using this approach, your heads will probably stay over the landing zone a good deal of the time, decreasing the chance that you'll have to toggle the power to your system while the heads are over valuable data.

You can download such a program—I often see one named Time Park*—from any large bulletin board. On CompuServe, for example, look for TPARK1.ARC in hardware data library 1.*

If you'd rather send off for Time Park *on a disk, contact The Public (software) Library (P.O. Box 35705, Houston, TX 77235-5705; (713) 721-5205) and ask for disk 1-UT-842. The disk includes numerous hard disk utilities, including* Time Park *and a similar utility that also includes a timed screen blanker. The disk will cost you a grand total of $5.*

■ Timed head-parking utilities automatically park the disk heads when there has been no disk activity for a specified period of time.

LASER MEMORY

I want to add RAM to my HP LaserJet series II, but I can't see paying the high prices asked by HP. Does anybody make a similar memory board for the LaserJet II's option slot that doesn't cost an arm and a leg? Also, I understand that the memory boards come in 1MB, 2MB, and 4MB configurations. If I buy the 1MB board now, can I add chips to upgrade it to 2MB or 4MB later?

Stephen Pitts
Fremont, California

Pacific Data Products Inc. (8525 Arjons Dr., Suite M, San Diego, CA 92126; (619) 549-0922) markets a line of memory boards for the LaserJet series II. The boards still don't go for dime-store prices, but Pacific's 1-2-4 boards will save you at least some money over HP's memory boards.

An unpopulated board sells for $295, while the 1MB version goes for $395. The 2MB and 4MB versions list for $895 and

■ PC ADVISOR

$1,595, respectively. For comparison purposes, the 1MB, 2MB, and 4MB HP boards carry list prices of $495, $995, and $1,995, respectively.

The 1-2-4 boards use socketed memory chips, so you can upgrade the board to your heart's desire. The 1MB version can be upgraded to either 2MB or 4MB by replacing as many as 16 of the 256K chips with 1MB chips.

1-2-3 CLONES

I'm a broke student who can't afford the cost of *Lotus 1-2-3*. Which of the low-cost *1-2-3* clones available on the market is best?

Julian Chow
Cleveland, Ohio

For low cost and 1-2-3 *compatibility, you can't go wrong with* VP-Planner *($99.95; Paperback Software, 2830 Ninth St., Berkeley, CA 94710; (415) 644-2116).* VP-Planner *has gained a lot of attention as the target of Lotus's "look and feel" lawsuit, which should be an indication of just how* 1-2-3*—compatible it is. But in addition to matching the features of* 1-2-3*, Release 1A, head to head,* VP-Planner *includes some power features of its own.*

For instance, VP-Planner *allows you to create* dBASE II *and* dBASE III *files or add data to existing* dBASE *files. It also lets you create multidimensional databases—with up to five dimensions—within* VP-Planner.

Borland's Quattro *(Borland International Inc., 4585 Scotts Valley Dr., Scotts Valley, CA 95066; (408) 438-8400), a newcomer to the spreadsheet field, also deserves mention. The initial version of* Quattro *suffered from a few* 1-2-3 *macro incompatibilities, but with any luck Borland will have taken care of these glitches by the time this issue hits the newsstands.*

Quattro *carries a suggested retail price of $195, but one advantage it boasts over* VP-Planner *is compatibility with* 1-2-3*, Release 2.01.* Quattro *also recalculates faster than* 1-2-3 *and sports a soft user interface, which means you can change the menu structure to suit your taste.*

All in all, either VP-Planner *or* Quattro *would rate as a wise buy. But before you opt for either, dig around at your university to see if you are eligible for any student discounts on* 1-2-3*. Lotus even offers an inexpensive student version of* 1-2-3*—available only through university bookstores and academic departments—that may suit your needs. The $39.95 student edition of* 1-2-3 *offers full Release 2.0 features but limits spreadsheet size to 64 columns by 256 rows.*

ASK THE ADVISOR

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Sure your co lots of things, b

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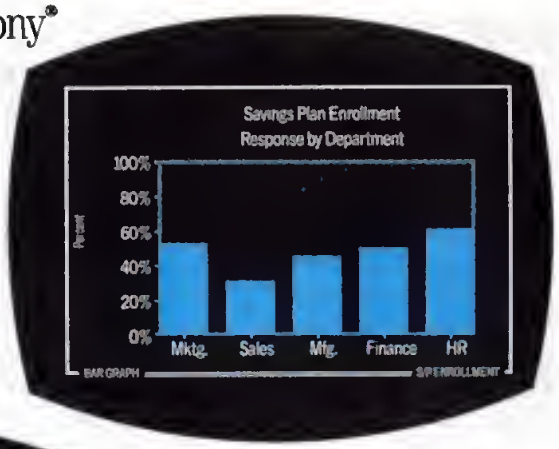

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PC MAGAZINE

FIRST LOOKS

Zenith Debuts the Battery-Powered TurbosPort/386, Two New Laptops

PC HANDS ON

BY NORA GEORGAS

When laptop computers started to become truly viable a few years back, Zenith, Toshiba, and NEC led the pack. Since then, the three companies have battled for supremacy in the small portables market, with more-or-less equal success. Zenith maintains its level footing with the other two with a new trio of laptops, including a battery-powered 80386-based machine that gives it an edge over NEC, which doesn't offer a 386 machine, and Toshiba, whose T3100 laptop doesn't operate on battery power.

A hybrid of clamshell and lunchbox designs, the Zenith TurbosPort/386 boasts a high-contrast "page-white" screen.

Zenith's spring lineup consists of the 80C88-based SupersPort, the SupersPort/286, and the brand-new TurbosPort/386. Prices span a wide range—from $2,399 for a basic SupersPort to $8,499 for a fully loaded TurbosPort, with plenty of permutations in between.

The good news is that the displays that made the Z-181 and Z-183 famous are better than ever. New display technology has enabled Zenith to produce a line of screens that is, across the board, better than what you saw on the previous models.

What should be the most appealing machine in the group is also the most puzzling. The TurbosPort/386 spurned the "lunchbox" laptop design convention exemplified by the Compaq Portable, but it's not a clamshell either (see photo).

(continues on page 34)

AST Machine Looks to Future, Remains Compatible with Past

PC HANDS ON

BY MITT JONES

Agonizing over whether to buy an IBM PS/2 Model 80 with its Micro Channel architecture or a Compaq Deskpro 386/20 with its ever-amazing speed?

The decision just got harder.

AST Research's Premium/386 not only offers 20-MHz performance and the armored-car construction we first saw in the Premium/286, but also a bus design that AST touts as an alternative to IBM's Micro Channel architecture (MCA). Like MCA, AST's new SMARTSlot architecture clears the way for add-in boards that boast their own processor. But AST's solution does retain compatibility with the XT and AT bus standards—standards IBM sacrifices with MCA.

Once up and running, the Premium/386 seems sluggish compared with the Compaq Deskpro 386/20. That sluggishness is due in part to the rather slow EGA board that AST supplies if you're willing to pay for it. PC Labs benchmark tests also showed disappointing performance on memory accesses, 80386 instruction mixes, and floating-point calculations.

But don't write the Premium/386 off. Even a slow 20-MHz machine is awfully fast. And regardless of any loss of appeal due to its lackluster speed, the Premium/386 is the only machine that has an XT/AT-compatible bus with multimaster capability.

To accomplish this feat, AST built an AT-type bus into the Premium/386 and added eight contacts to three of the 16-bit AT slots. These contacts constitute the multimaster bus extension—the data pathway dedicated to bus arbitration.

The multimaster slots—or SMARTSlots—will gain you nothing until AST or third-party manufacturers begin shipping

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HANDS-ON INDEX

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Photograph Thom O'Connor

Zenith

(continued from page 33)

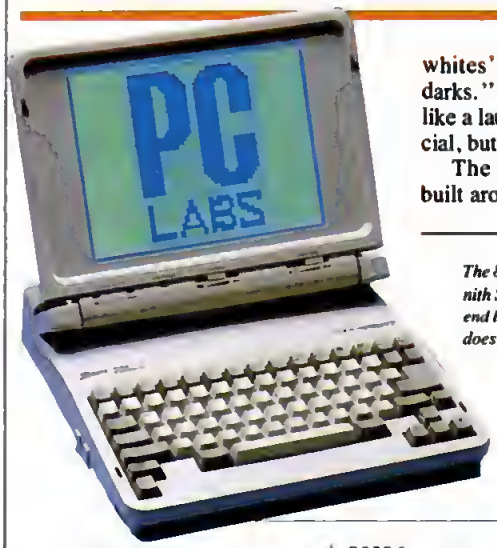
One of the things that makes the TurbosPort look so odd also makes it work better. The processor is located in the pop-up screen, where air can circulate around the components and keep them cool. This makes for a thick "lid" but prevents the unpleasant hot-metal effect you get on a GRiDCase 386 or Toshiba T3100.

Other design decisions are not so easily justified. Take the keyboard. No doubt designed to add minimum weight to an already leaden (25 pounds) machine, the detachable keyboard, connected by a coiled cable à la Compaq, feels insubstantial. As the keyboard on our review unit slid around the table like a Ouija board, Zenith engineers assured us that more-effective rubber feet would be attached to production models.

You may not notice the ice-rink feel if you're concentrating on the screen. It is, without doubt, the best display to date on a portable computer. Crisp, dense black characters on a white background make it a joy to read. The secret of the display, which Zenith calls "page-white," lies in an extra layer of polarizing material that reabsorbs most of the blue light produced by the regular polarization process, resulting in "whiter whites" and "darker darks." It may sound like a laundry commercial, but it works.

The SupersPort/286 laptop packs a zero-wait-state 80286 microprocessor and a backlit supertwist LCD display.

The two SupersPort laptops are lighter and more modern-looking than their predecessors. Both have articulated screens that fold back completely to give maximum choice of viewing angles.



The 80C88-powered Zenith SupersPort is a low-end laptop machine that does not skimp on features: a backlit supertwist LCD screen is standard along with a full-size keyboard.

The TurbosPort is built around a 12-MHz 80386 processor, switchable to 6 MHz. Standard features include 2MB RAM and a 40MB internal hard disk. EMS support and a 2,400-bit-per-second modem are optional.

Battery operation is handled in an interesting way in all three machines. Nickel cadmium batteries are contained in a unit that clips on the back, so if you know you're going to be operating off AC power and would like to shed a few pounds, you can unclip the battery pack and leave it behind.

Battery life remains the bane of 386-based laptop operation. At this writing, Zenith was still working on increasing the TurbosPort's battery life, which was clocked between 30 and 45 minutes. That's better than the GRiDCase 1530's 20 to 30 minutes, but it ain't great.

Battery operation may not be important with this machine, though, since it's large and heavy enough to demand use on a desk or other wide, flat surface. It is not a laptop machine by any stretch of the imagination.

The TurbosPort/386 is something of an enigma—its screen is outstanding, some of its design features are quite clever, and its processing power is more than accurate. But it's heavy and expensive, it has a weak keyboard, and its unconventional design may be a strike against it in an already well-defined market.

SupersPort Laptops

More traditional and, because of their less-astronomical prices, more accessible to the general user are the two SupersPorts. Both clamshell designs with full keyboards, these machines are trimmer and more compact than the Z-181 and Z-183, partly because the excess margin around the screens has been reduced.

The two SupersPort laptops are lighter and more modern-looking than their predecessors. Both have articulated screens that fold back completely to give maximum choice of viewing angles and to allow you to set a desktop monitor on top of the machine.

With its standard 8-MHz 80C88 chip, 640K RAM, and EMS support, the SupersPort is a good low-end laptop. It costs considerably more than the rival Toshiba T1000, but it has a full-size keyboard and a very nice backlit screen.

The SupersPort's 286-powered sibling may be the machine that appeals most to mainstream laptop users. Powerful enough for almost all computing tasks, it retains laptop usability and provides a great screen, too.

The zero-wait-state 12-MHz 80286 microprocessor is as fast as some 386s and uses less power than a one-wait-state chip. One megabyte of RAM and EMS support come standard, as well as a 20MB hard disk drive and a 1.4MB 3½-inch floppy disk drive. The double-scanned backlit screen increases resolution and yields sharper characters. And at less than 12 pounds, the SupersPort/286 could be a very pleasant traveling companion indeed. PC

PC MAGAZINE FACT FILE

SupersPort
SupersPort/286
TurbosPort/386
Zenith Data Systems
1000 Milwaukee Ave.
Glenview, IL 60025
(312) 699-4800
List Price: SupersPort: with two floppy disk drives, $2,399; with 20MB hard disk, $3,599. SupersPort/286: with 20MB hard disk, $4,999; with 40MB hard disk, $5,599. TurbosPort/386: with 40MB hard disk, $7,999; with 40MB hard disk and 2,400-bps modem, $8,499. All prices subject to change after April 19.
In Short: Two solid laptops, one based on the 80C88 processor and the other on the 80286 processor. A third machine, a portable 386, blends a crisp Zenith screen display with powerful processing but has a hefty weight and a hefty price tag.

CIRCLE 446 ON READER SERVICE CARD

Photographs: Thom O'Connor

AST Premium/386

(continued from page 33)

boards designed to AST's new standard.

In the meantime, however, the SMARTSlots won't stand in your way. Since AST simply added an extension—along with the necessary arbitration logic—to the industry-standard bus, the SMARTSlots accept XT- or AT-compatible cards with no problem. In addition, you get two standard 8-bit slots and one standard 16-bit slot.

Like Compaq's Deskpro 386/20, the Premium/386 also separates the memory pathway from the system bus. All system RAM—up to 13MB—sits on a proprietary adapter that installs in a dedicated 32-bit slot. This allows the memory bus to operate at 20 MHz while the system bus runs at a safe 8 MHz.

Unfortunately, AST failed to take full advantage of the 20-MHz speed. Instead of using a static RAM memory cache in front of slow DRAM—the route Compaq has taken—AST elected to outfit the Premium/386 with static-column RAM (not to be confused with the faster static RAM).

The result? A disappointing performance of .6 seconds, compared with the Compaq's .4 seconds, on the conventional memory read portion of the PC Labs tests. It's worth noting, however, that the hit-and-miss nature of memory caches closes this performance gap during some applications.

If your desktop cries out for the fastest machine around, and you couldn't care less about a multimaster bus, go with the Compaq. If you're looking for a server that will give a large network everything the future has to offer, give up your XT and AT expansion boards and go with the Model 80's elegant MCA. If you're somewhere in between, go with the AST Premium/386. PC

"Standards" Proliferate as AST Jumps on Multimaster Bandwagon

IBM touts its Micro Channel architecture (MCA) as the future bus standard. MCA isn't compatible with the XT/AT bus, but it has sophisticated bus arbitration for tomorrow's coprocessor boards.

Meanwhile, Compaq rips ahead with its Deskpro 386/20, which retains XT/AT bus compatibility and stays away from sophisticated bus arbitration schemes. Compaq insists that with a machine as fast as the 386/20, you don't need coprocessor boards.

Now AST's SMARTSlot architecture offers yet another would-be "standard," one that combines XT/AT bus compatibility and bus arbitration.

AST promises to release several SMARTSlot-compatible coprocessor boards. And, in hopes that other vendors will hop on the SMARTSlot bandwagon, AST is offering design specifications to anyone who requests them. As this issue went to press, however, AST was unable to name any companies that are planning products for the SMARTSlot architecture.

—Mill Jones

FACT FILE

AST Premium/386
AST Research Inc.
2121 Alton Ave.
Irvine, CA 92714
(714) 863-1333
List Price: Model 300, with 1MB RAM, no hard disk drive, $4,695; Model 340, with 1MB RAM, 40MB hard disk drive, $5,695; Model 390, with 2MB RAM, 90MB ESDI hard disk drive, $7,695; Model 3150, with 2MB RAM, 150MB ESDI hard disk drive, AST Advanced Disk Controller card, $8,999. All models include 1.2MB 5¼-inch floppy disk drive. Monitor extra.
In Short: A competent, well-built 20-MHz 386 with an intriguing proprietary bus architecture.

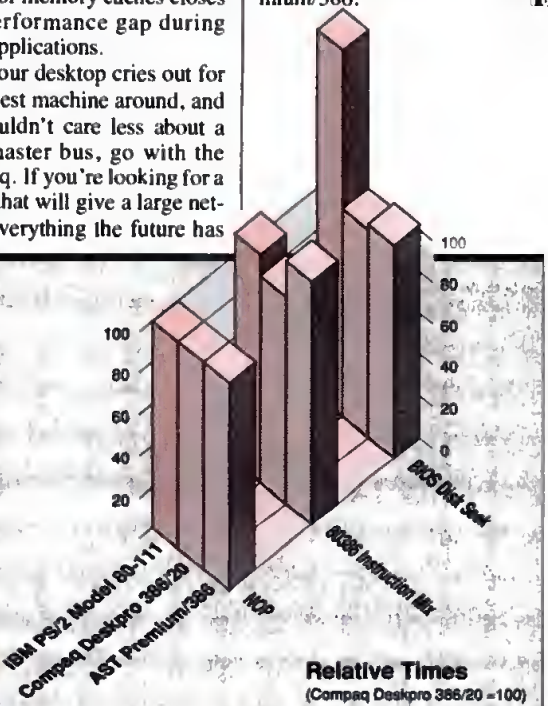
CIRCLE 433 ON READER SERVICE CARD

Benchmark Tests: AST Premium/386

We didn't expect the AST Premium/386 to beat the speedy Compaq Deskpro 386/20, but we were surprised when AST's offering proved slower than the sluggish IBM PS/2 Model 80 on the 80386 Instruction Mix test. The most likely reason for the less-than-blazing speed is AST's use of static-column RAM instead of a static RAM memory cache in front of DRAM—the approach taken by Compaq.

Performance Times
(Times given in seconds except where noted)

	NOP	80386 Instruction Mix	BIOS Disk Seek (milliseconds)
IBM PS/2 Model 80-111	1.7	3.2	32.7
Compaq Deskpro 386/20	1.7	2.9	18.5
AST Premium/386	1.7	3.4	19.0



The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

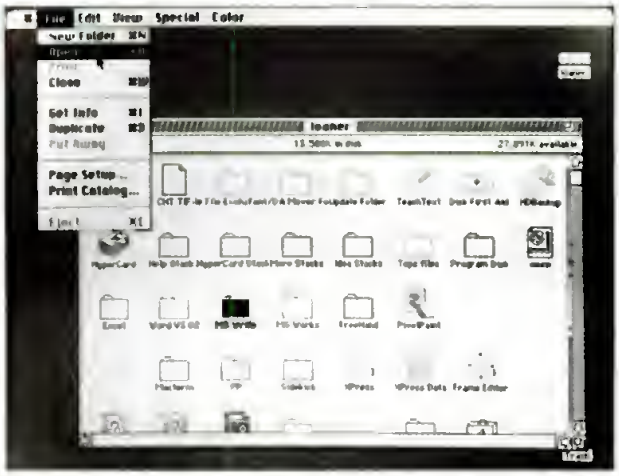
The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

Sorting Out Fact from Fiction In the Apple-Microsoft Lawsuit

PC ANALYSIS

BY JOHN C. DVORAK



Clean, distinctive, and accessible, the Macintosh interface has inspired many developers. Now Apple says some imitators have gone too far.

The industry knew that the litigious Apple Computer Corp. would take action. The question was when. That question was answered on Thursday, March 17, when Apple filed a lawsuit claiming that Microsoft had violated terms of an agreement to use certain Apple technologies in the user interface of *Windows* 1.0.

According to Apple, Microsoft has gone too far with its release of *Windows* 2.03. Hewlett-Packard was also named in the suit after it produced a new *Executive* for *Windows* called *New Wave*, which turned out to be a clone of the Macintosh interface. (In the There's No Such Thing as Bad Publicity Dept.: Orders for *New Wave* developers' kits have skyrocketed since Apple's suit was announced. Whatever happens to HP legally, the company can't be *too* distressed about the suit just now.)

Apple's action will result in lots of theorizing. Here are some facts and some observations. Let's start in 1985, when Apple first thought of suing Microsoft for using techniques patented by Apple (under patent number 4,464,652) and for using certain Apple visual copyrights. Microsoft chairman Bill Gates got wind of this potential suit and flew down with a lawyer to Cupertino. In a late night meeting with Apple CEO John Sculley, he threatened to stop development of all Mac software if Apple pursued legal action. This incident is outlined in Sculley's book, *Odyssey*, where the story ends with the simple statement: "We made our peace in November."

What wasn't mentioned in the book, and the reason the attorney accompanied Gates, was that Sculley was asked to sign a document that gave Microsoft royalty-free rights to the Apple patents and to the copyrights to the visual screens. To add insult to injury, there was an indemnification clause making Microsoft immune from any third-party suits over the interface. All Apple got from Gates was an assurance that Mac development would continue. As a gratuity, Microsoft granted Apple the rights to the visual copyrights to any *Windows* screens it developed from 1985 to 1990.

Sculley, not sure if Gates was serious about stopping Mac development during a crucial period for the Mac, signed the document on November 22, 1985.

Most insiders believe Gates was bluffing, since much of his company was concentrating on Mac development. Whatever the case, the document also made it clear that Microsoft did not have to credit Apple or make it known that Microsoft had permission to use certain Apple technologies. To the outside world there was no agreement. Both companies agreed to make the secret document public on March 21, 1988, as part of the litigation and disclosure process.

The agreement also said that if the agreement was breached in any way it would be invalidated. Publicizing and invalidating the original agreement may be Apple's ultimate goal. All Apple needed was one slip by Microsoft. In fact, it may be that Microsoft's use of the number 2.03 in the release for which it is being sued is the slip-up. The secret document specified that only Version 1.0 was covered. Microsoft claims that the only additional features in 2.03 are proprietary. The courts will decide these issues.

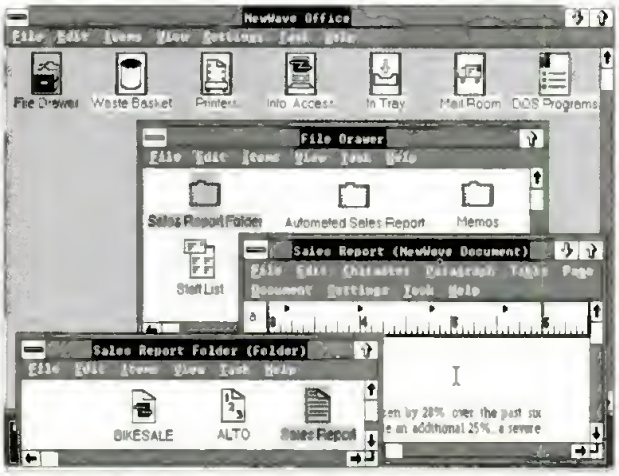
If there is a small violation of the agreement, then Microsoft and, presumably, IBM and others have a problem. Some think the shoe is on Sculley's foot, with IBM the real target of a swift kick. Gates is now caught in a bind that could cost Microsoft dearly if IBM is embarrassed and falls off the critical path leading to full implementation of SAA (Systems Applications Architecture), starting with the complete OS/2 Presentation Manager.

Obviously aimed at IBM and developers of applications running under *Windows* and OS/2, along with those who might be considering the release of a Mac clone, the suit will forestall any competition until its resolution.

Mention is made about how the graphical user interface was developed by Xerox and Apple can't sue anybody.

The fact is, Apple owns rights to the interface, thanks to a deal made long ago for which Xerox got 2 percent of Apple stock (since sold). Sun Microsystems has always been concerned about the proprietary aspect of the interface and quietly obtained a license from Xerox long ago. And even Microsoft has a license from Xerox.

Microsoft doesn't like to license anything and rarely talks about its agreement with Xerox. Microsoft likes to think of itself as a licenser, not a licensee. It was probably to protect that image that Gates insisted that the Apple agreement be held in confidence. It can also be argued, though, that the agreement was an embarrassment to both companies since it is so one-sided. Surely, it would not pass the scrutiny of a public forum. PC



Look familiar? It's not as elegant, and the DOS program icon is something you won't see on a Macintosh screen (yet), but other than that . . .

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CIRCLE 479 ON READER SERVICE CARD

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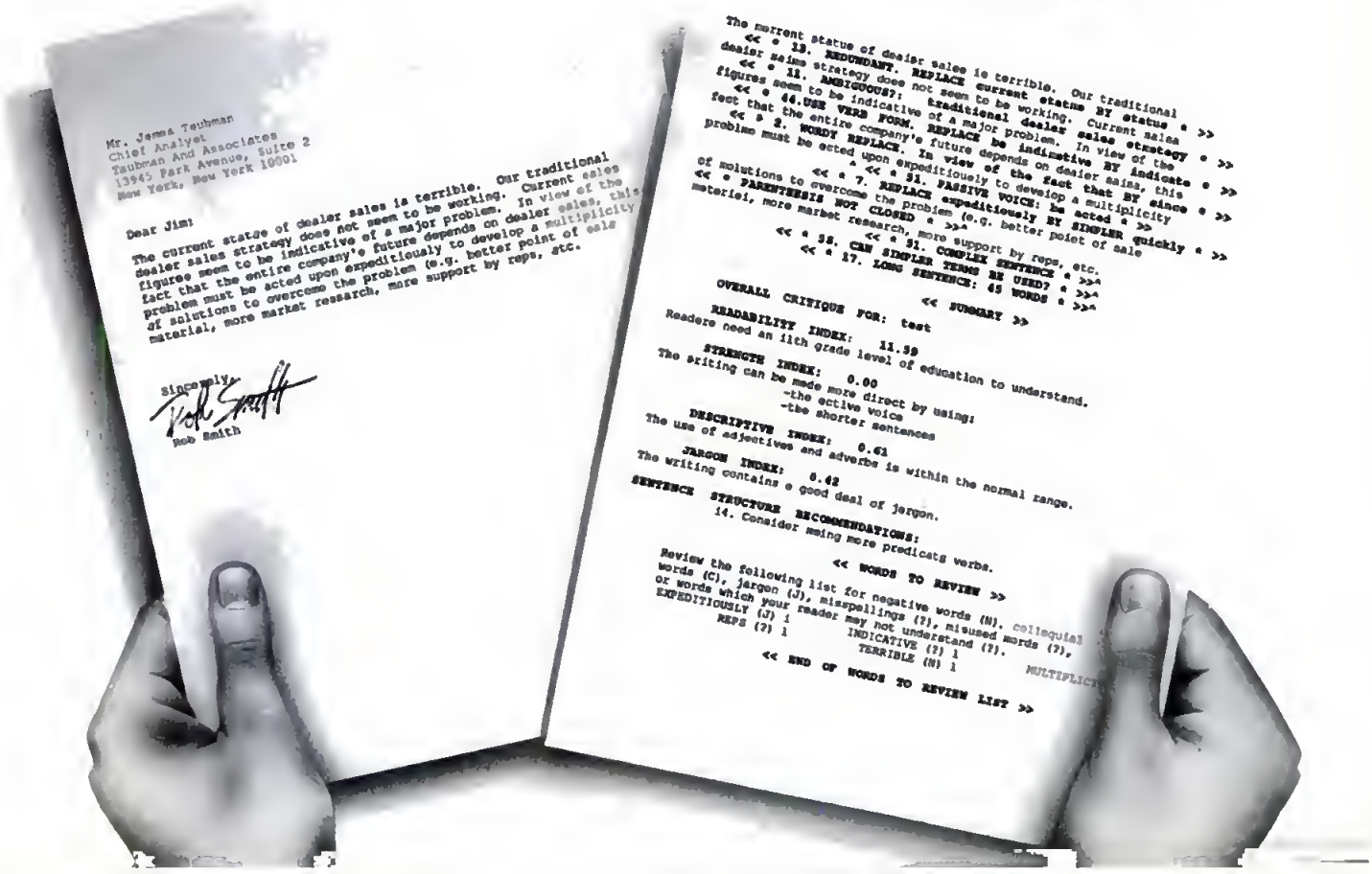

Unconventional Design Yields Mixed Results in Amstrad Laptop

PC HANDS ON

BY JONATHAN MATZKIN

Sometimes different is better, but in the case of the Amstrad PPC640 portable computer, different is just different. Though the PPC640 offers an attractive array of features at a reasonable price, strange design decisions undercut the machine's usefulness.

The system comes with 640K RAM, and the $1,199 list price includes two 3½-inch floppy disk drives and a Hayes-compatible, 2,400-bit-per-second internal modem. The system does not support an internal hard disk.

The PPC640 looks like no other portable you've seen. It was obviously designed around its full-sized 101-key keyboard, which swings into place on a hinge that attaches it to the body of the PPC640. With the keyboard latched in place for transportation, the PPC640 has dimensions of 4 by 17½ by 9 inches (HWD).

With the keyboard unfolded, the unit is 16 inches deep, making use on an airplane tray table a questionable proposition.

The PPC640's supertwist LCD display is a diminutive 9 inches measured diagonally. The screen isn't backlit, and the blue-on-green image doesn't compare with the viewing quality on other laptops.

Among the Amstrad PPC640's unusual features are its small flip-up LCD screen, full-size typewriter-style keyboard, and side-mounted handle.

The PPC640 also bucks the trend when it comes to battery power. It runs on batteries, but not the rechargeable battery pack found in most portables. Instead, the PPC640 accepts ten ordinary C cells, just like the ones in your flashlight.

When battery power runs low, the PPC640 emits a piercing tone to warn the user. Accessing the floppy drives when power is starting to flag can trigger this alarm. You are serenaded by this high-pitched sound as long as the drive spins.

Amstrad is unspecific about battery life, but the manual suggests keeping floppy drive and modem use to a minimum while running on batteries.

Amstrad advertises the PPC640's weight at 11 pounds. With batteries installed, we weighed it at a tad over 13 pounds.

Our processor benchmark test shows that the PPC640 outperforms a standard IBM PC-XT, courtesy of its 8086-compatible NEC V30 processor.

The PPC640 is a basic, functional DOS compatible, but its unwieldy design limits its usefulness. PC

PC MAGAZINE FACT FILE

Amstrad PPC640
Amstrad Inc.
1915 Westridge Dr.
Irving, TX 75038
(214) 518-0795
List Price: $1,199
In Short: Some good ideas, like a full-sized 101-key keyboard, get lost in a design that is unwieldy and ergonomically weak.

CIRCLE 430 ON READER SERVICE CARD

3-2-1 Blastoff Speeds Recalcs

PC HANDS ON

BY DAVID DEJEAN

Don't let the name fool you.

3-2-1 Blastoff, from Frontline Systems, is not just another cutesy-pie *Lotus 1-2-3* add-in where most of the intellectual effort went into coming up with a name that plays off *1-2-3*.

Blastoff is grown-up, hard-working, hairy-shouldered software for people who have problems with *1-2-3*'s sluggish recalc function.

Blastoff is actually two programs: the Blastoff module works outside *1-2-3*, compiling worksheets into quick-executing machine code. A second program called Booster works from within *1-2-3*, calling up compiled versions of worksheets whenever you issue a recalc command.

Booster includes a minimal-recalc function that recalculates only cells that have changed and skips over those that haven't. Where *1-2-3*'s Speed-Up utility will improve recalc times anywhere from 20 to 40 percent, depending on the nature of the sheet, Booster does slightly better even without a math coprocessor.

Add a math chip and Booster flies, cutting the recalc time of most sheets in half. One test sheet that does 60,000 square-root calculations in 10,000 cells took 10 seconds to recalc on a 12-MHz AT clone. Booster cut the time to under a second—a tenfold improvement.

Booster needs 64K RAM to fit *1-2-3*'s Add-In Manager, Booster itself, and libraries for the 287 calls and Booster's own super-stock versions of *1-2-3*'s @ functions. The compile process adds a further 2-byte tag to each active cell in the compiled worksheet. This means worksheets that approach the limits of available memory (particularly in machines with 640K or less) won't work with *Blastoff*. It also means you can kiss your RAM-resident utilities goodbye while you're using Booster in *1-2-3*.

Blastoff works intelligently with expanded memory (by trying to ignore it whenever it can and keep worksheets in conventional memory, where they recalc faster). *Blastoff* is packaged on both 5¼-inch and 3½-inch diskettes, and it comes with a manual that explains the program, clears some of the fog surrounding math coprocessors, and is so well written that it's a pleasure to read for its own sake. PC

PC MAGAZINE FACT FILE

3-2-1 Blastoff
Frontline Systems Inc.
140 University Ave., #100
Palo Alto, CA 94301
(415) 327-7296
List Price: $124.95
Requires: *Lotus 1-2-3*, Release 2.0 or 2.01; math coprocessor.
In Short: A *1-2-3* accelerator that really works. Compiles a worksheet into machine code that cuts recalculation times of unadorned *1-2-3* by 50 to 90 percent.

CIRCLE 432 ON READER SERVICE CARD

Photographs: Thom O'Connor

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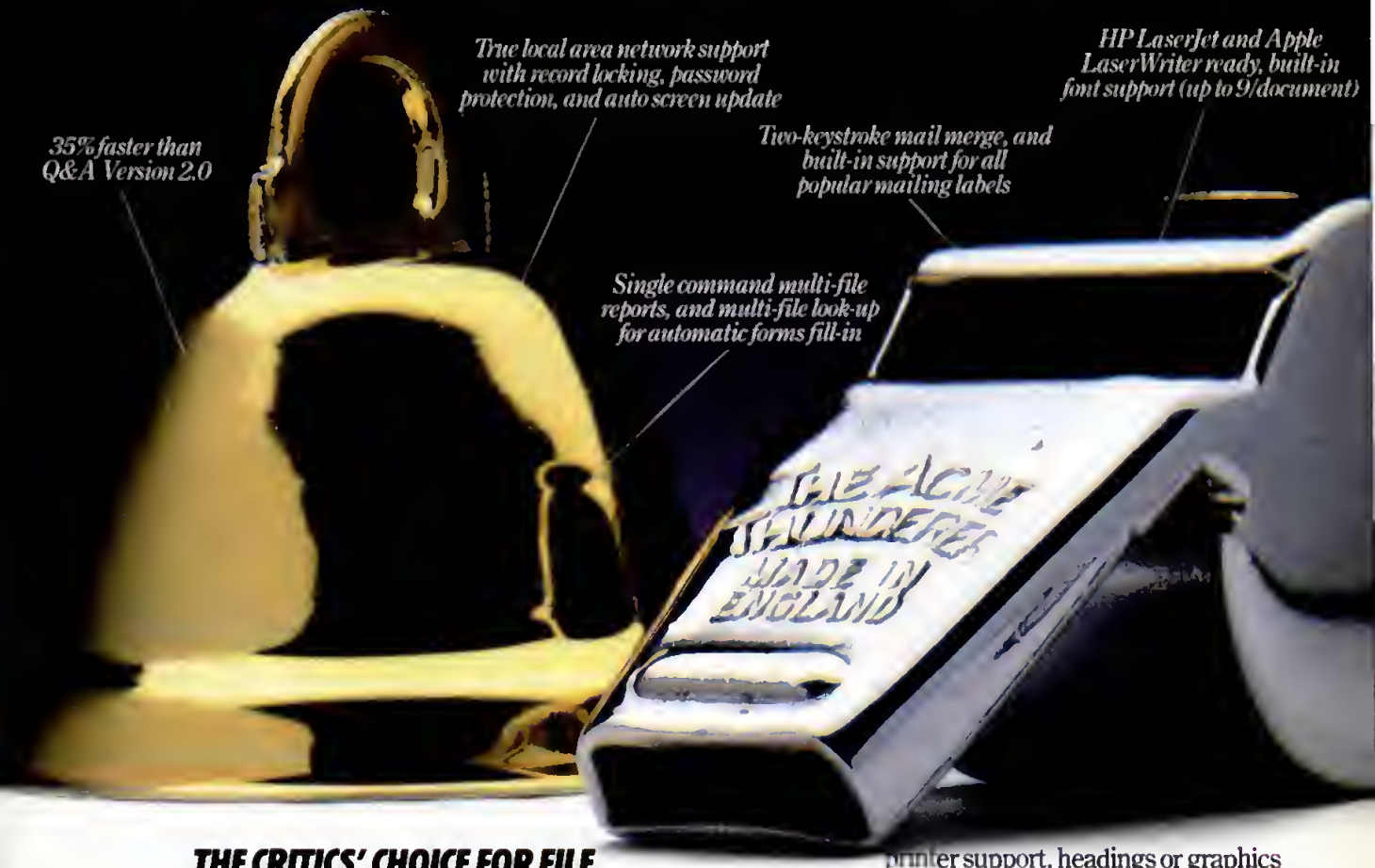

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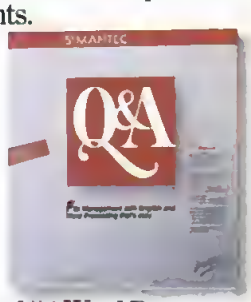

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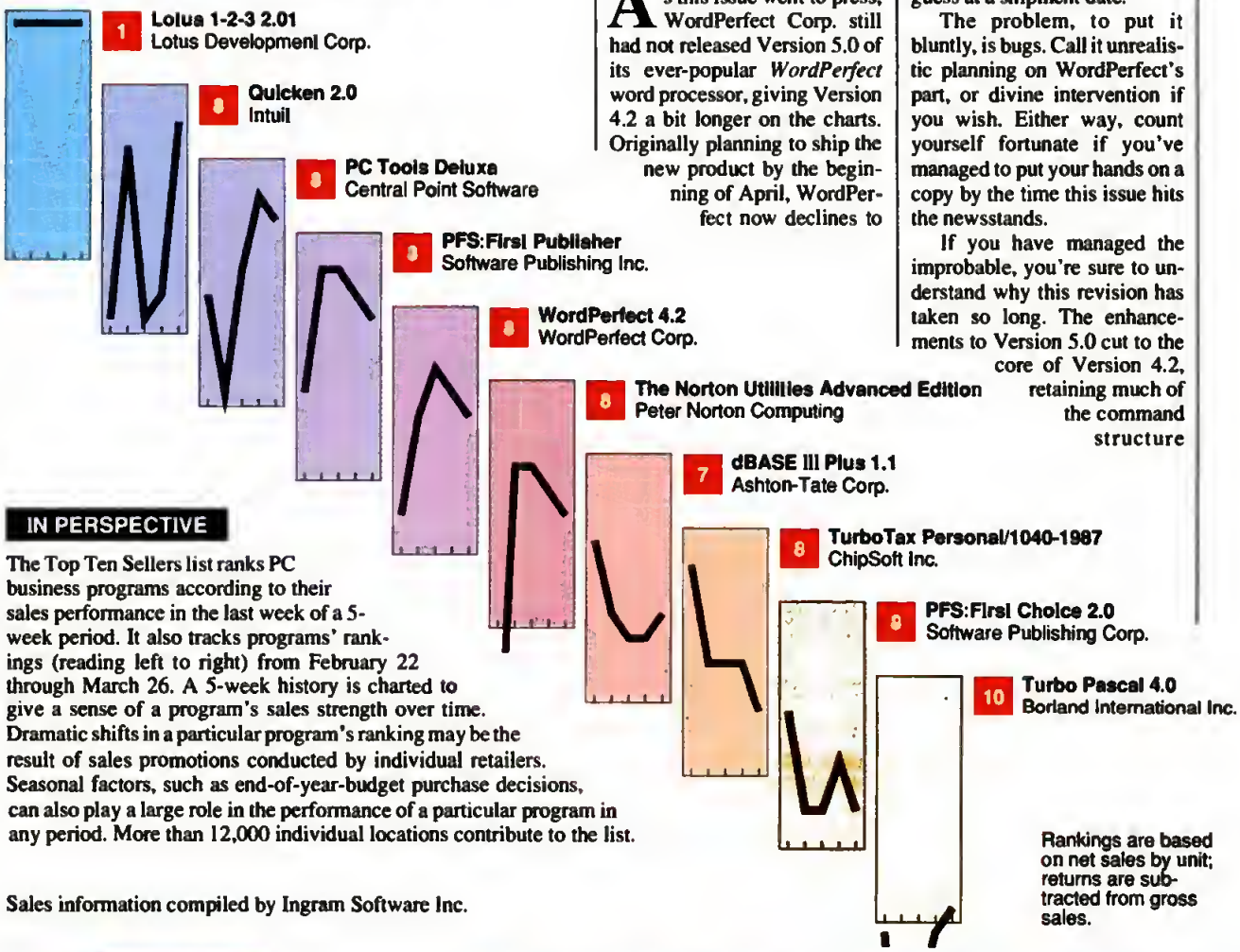
CIRCLE 745 ON READER SERVICE CARD

PC MAGAZINE PIPELINE

TOP TEN SELLERS



1 **Lotus 1-2-3 2.01**
Lotus Development Corp.

2 **Quicken 2.0**
Intuit

3 **PC Tools Deluxe**
Central Point Software

4 **PFS:First Publisher**
Software Publishing Inc.

5 **WordPerfect 4.2**
WordPerfect Corp.

6 **The Norton Utilities Advanced Edition**
Peter Norton Computing

7 **dBASE III Plus 1.1**
Ashton-Tate Corp.

8 **TurboTax Personal/1040-1987**
ChipSoft Inc.

9 **PFS:First Choice 2.0**
Software Publishing Corp.

10 **Turbo Pascal 4.0**
Borland International Inc.

IN PERSPECTIVE

The Top Ten Sellers list ranks PC business programs according to their sales performance in the last week of a 5-week period. It also tracks programs' rankings (reading left to right) from February 22 through March 26. A 5-week history is charted to give a sense of a program's sales strength over time. Dramatic shifts in a particular program's ranking may be the result of sales promotions conducted by individual retailers. Seasonal factors, such as end-of-year-budget purchase decisions, can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

Sales information compiled by Ingram Software Inc.

Rankings are based on net sales by unit; returns are subtracted from gross sales.

As this issue went to press, WordPerfect Corp. still had not released Version 5.0 of its ever-popular *WordPerfect* word processor, giving Version 4.2 a bit longer on the charts. Originally planning to ship the new product by the beginning of April, WordPerfect now declines to guess at a shipment date.

The problem, to put it bluntly, is bugs. Call it unrealistic planning on WordPerfect's part, or divine intervention if you wish. Either way, count yourself fortunate if you've managed to put your hands on a copy by the time this issue hits the newsstands.

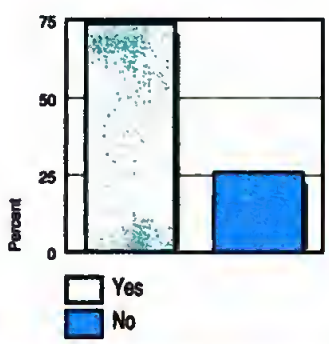
If you have managed the improbable, you're sure to understand why this revision has taken so long. The enhancements to Version 5.0 cut to the core of Version 4.2, retaining much of the command structure

PC MAGAZINE SURVEY

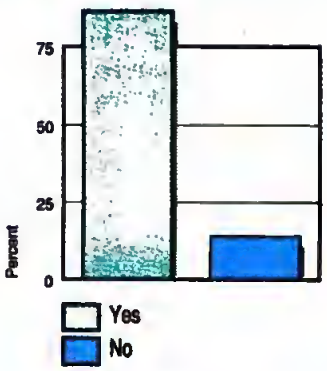
People don't program for money alone. That message came through loud and clear when we polled readers about their language preferences. Some do it on the job, but even more do it on their own time.

More than one in five prefer BASIC, but coming up fast is C. When we asked readers which languages they use or are considering using (results not shown), it became clear that Microsoft and Borland have most of the turf divided up between them.

Do you write programs for your company?



Do you write programs as a hobby?



WordPerfect users are accustomed to but drastically altering the program internals and adding important new features.

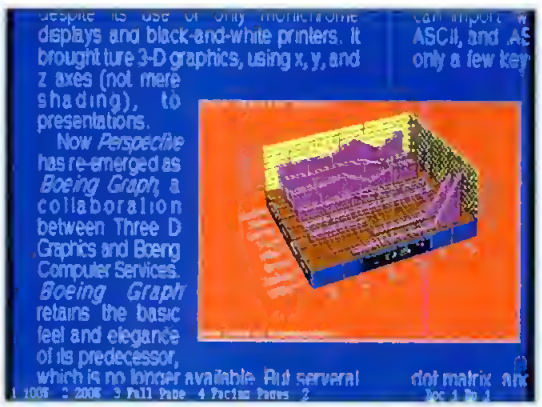
Modern Margins

Probably the most dramatic change in *WordPerfect* revolves around its handling of margins and fonts. Version 4.2's insistence on specifying margins by column position made changing font sizes a pain. You had to keep a calculator handy to figure out how the pitch translated into the margin widths you needed. And you could forget trying to change font size in the middle of a line.

Version 5.0 changes all that. You now specify margins in inches rather than by column position. This may seem a bit foreign at first, but once you grow accustomed to it the advantages are clear. It puts the burden of calculating the number of characters in each line on the program, where it belongs.

WordPerfect has also completely revamped the program's antiquated handling of fonts. Ctrl-F8 now calls the font menu, which in turn allows you to pick a "base font" for your document. You choose from a list of your printer's fonts. If you specify that you're using the HP LaserJet Plus with a Z cartridge, for instance, you'll see a one-line description of each font the Z cartridge produces.

SNEAK PREVIEW — WORDPERFECT 5.0



Among the enhancements included in *WordPerfect*, version 5.0, are a document preview mode with zoom features and the ability to incorporate color graphics in text files.

Once you've chosen a base font, *WordPerfect* 5.0 automatically picks the corresponding italic, bold, and bold italic font when you request those attributes in your document. You can also specify a larger or smaller font of the same type style by picking "very small" or "large," for instance, from a font-size menu. And you can change to a new base font at any point during a document.

This not only makes selecting fonts more straightforward, but also allows *WordPerfect* to select the closest corresponding fonts if you print a document created for one printer on another printer.

The ability to embed color graphics into documents and preview them on-screen undoubtedly rates as the most eye-catching new feature. The program handles nearly every major graphics-file format known to the PC, and you can use *WordPerfect*'s screen-grabber utility if all else fails. You specify the size and position of the graphic frame within your document, and a graph edit function lets you scale, rotate, or move the graphic within the frame.

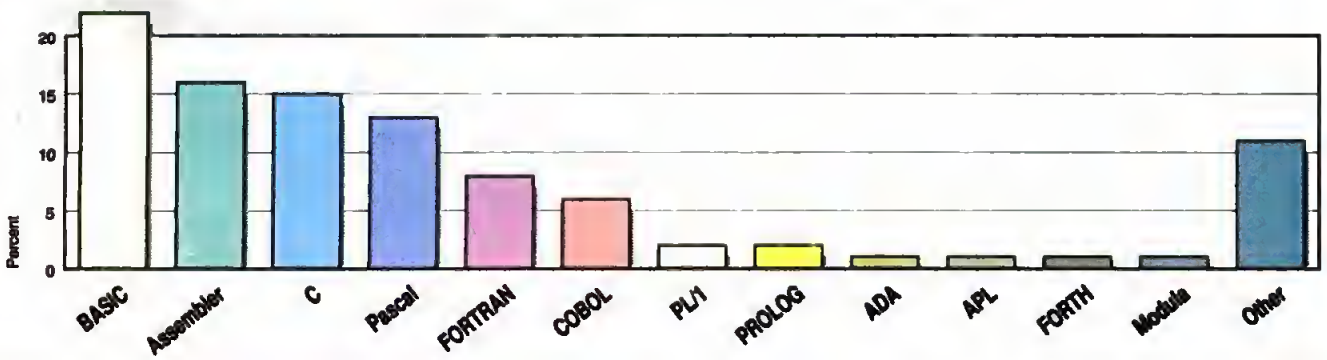
The document preview feature approaches true WYSIWYG. In addition to displaying graphics, it gives you a nice on-screen representation of the fonts you've used. Two levels of zoom let you closely inspect your masterpiece.

The list of significant enhancements doesn't stop there. The Style Definition feature lets you create and recall document formats or even often-used format changes, for example. And the Master Document feature links separate files as if they were one large document, an advantage when generating page numbers, tables of contents, indexes, and the like.

Watch upcoming issues for our hands-on review of *WordPerfect* 5.0. And keep an eye on our best-sellers chart.

—Mitt Jones

Which of the following programming languages do you or others in your company use?



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CIRCLE 111 ON READER SERVICE CARD

Symantec's New Version of Q&A Makes a Good Thing Even Better

PC HANDS ON

BY GENE SMILGIEWICZ

Symantec Corp. has redefined the state of the art for facile file managers and word processors by instilling its new version of *Q&A* with over 100 new or enhanced features. *Q&A*, Version 3.0, is not only easier to use than previous versions, it is also capable of taking on more-elaborate applications.

Q&A integrates a flat-file database manager, a feature-laden word processor, and an English-language query module under one roof. It has won a place in the hearts and computers of legions of users as much for its speed and ease of use as for its feature-set.

Anyone who maintains and analyzes lists of data can be up and running with *Q&A* in no time. Just lay out a master form on your screen (use multiple screens for lengthy forms), describe the type of data contained in each field, and enter your data. Abundant help and options help you customize forms, and you can also "program" your form by embedding a wide range of @functions or conditional statements in field definitions. A well-implemented report writer enables you to produce effective reports.

Q&A's "Intelligent Assistant" (one of the earliest implementations of artificial intelligence technology for PCs) can then be called upon for ad hoc queries and reports. After it scans a database, the Intelligent Assistant can process queries such as "Show me unpaid invoices over 30 days old." While the novelty of using "English" soon wears off, the ability to limit the scope of retrieved records with follow-up queries (such as: "Only those from NY") is genuinely useful.

Q&A's Write module holds its own against any "full-featured" word processor for most WP tasks while providing a few rare features of its own, such as inclusion of *1-2-3* worksheet ranges and graphs in documents. For speed of operation, few of its muscle-bound cousins can compare with *Q&A*. Its close coupling with the database makes *Q&A* Write the best mail-merge tool around.

> *Q&A*'s Write module holds its own against any "full-featured" word processor for most WP tasks while providing a few rare features of its own.

Leading the parade of improvements in 3.0 are a new external file lookup feature (XLOOKUP) and multiuser network support. Hitherto limited to data contained in the "forms" and integral lookup table of a single file, *Q&A* users will now be able to access data in multiple secondary files. Thanks to this feature, classic multifile applications such as billing, where invoice, customer, and product data are stored and maintained most effectively in separate files, can be implemented efficiently.

In the networking department, *Q&A*'s new automatic record and file locking are useful when multiple users attempt to update a form or print a report simultaneously. Changes made to a form by one user are instantly reflected on the screen of any other user viewing the form. Multilevel password protection is also available.

The production of form letters and mailing labels, which Symantec says is the most common *Q&A* application, also benefits from multifile capability. You will probably be equally impressed by the vastly simplified mail-merge facility and flexible mailing label options.

To place a database field within a merge-oriented document or label template, you need only press the "list fields" key, then select the one you want from a pop-up list. Printing out labels is child's play—just select the label utility from the Write menu and choose a template. Symantec provides 19 predefined, customizable formats, including six for laser printers that compensate for dead zones at the top and bottom of the sheet.

Symantec has paid special attention to HP LaserJet and PostScript printer support. You choose from an abundant font menu, and you can use up to nine different fonts on a single page.

Up to five separate printers or print modes can be assigned to any one or a combination of LPT and COM ports. This lets you print preliminary drafts of a document on a dot matrix printer, switch to NLQ mode for an intermediate version on the same printer, then print a final copy on a networked laser—all without having to either reset printer menus or modify the document.

The list of changes also includes a new pop-up menuing system, EMS support, an improved spelling checker, advanced search-and-replace, improved file searching, database recovery, reporting and programming functions, the simplified Intelligent Assistant, Macintosh connections, and the ability to run other programs from the main *Q&A* menu.

Q&A 3.0 is what every software user wishes for: an impressive update of an already excellent product.

Version 3.0 of Q&A improves the mail-merge function and adds network capabilities. The status line (bottom) tells you when someone is using the file.

PC MAGAZINE FACT FILE

***Q&A*, Version 3.0**
Symantec Corp.
10201 Torre Ave.
Cupertino, CA 95014
(408) 253-9600
List Price: $349; upgrade, $50 (free if Version 2.0 purchased after February 1, 1988); network pack (three additional users), $299.
Requires: 512K RAM; two disk drives; DOS 2.0 or later. Network use requires 640K RAM and DOS 3.1 or later.
In Short: Highly recommended for fundamental database and word processing tasks. Exceptional speed, nonpareil mail-merge, excellent printer support. Not copy protected.

CIRCLE 445 ON READER SERVICE CARD

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CIRCLE 206 ON READER SERVICE CARD

PC Magazine Starts New On-line Service

PC PREVIEW

BY CHRISTOPHER BARR AND BILL MACHRONE

Maybe the long-distance charges of the PC Magazine Interactive Reader Service have been too onerous. Maybe you got tired of fighting the busy signals while trying to download free software from an on-line service that was too tricky. No more. Now you can join hundreds of thousands of CompuServe and IRS users in an unprecedented combination of these two important systems—PC MagNet.

On May 1, *PC Magazine* introduced PC MagNet, the on-line service designed to bring the magazine's reviews, productivity tips, and opinions within reach of everyone with a modem. No longer content to be a one-way communicator, we're using the very technology we write about to make *PC Magazine* an even more valuable resource to you.

PC MagNet moves beyond the limitations of the existing Interactive Reader Service to add badly needed new features and make access easier for you. PC-IRS was accessible only through two numbers, one in New York, the other in California. The 44 incoming lines were in constant use, causing busy signals and limiting the time readers could spend downloading *PC Magazine* utilities.

PC MagNet, administered by CompuServe, uses the full CompuServe network, including Telenet and TYMNET access. More than 300 phone numbers are available throughout the continental U.S. via CompuServe's network. Telenet and TYMNET add hundreds more. That means that in practically every dialing exchange in the country, PC MagNet is only a local call away.

PC-IRS responded to thousands of callers a day—a lot of traffic for eight PC ATs and 44 modems to sustain. The significantly superior power of CompuServe's network enables us to virtually eliminate the busy signals as well as to expand the service at every level.

For over 125,000 *PC Magazine* readers who are already CompuServe members, it's easy to use the new service. Just type GO PCMAGNET at the ! prompt. For those of you who have yet to try the pleasures of on-line services, we've set up an easy sign-up system.

On PC MagNet, all the *PC Magazine* utilities are available, including files that we couldn't fit on the IRS: code from User-to-User, Power User, and PC Tutor. Old programs and source code will be available, as will the utilities and shorter routines we publish in every issue. Of course, the PC Labs Benchmark Series of test programs will also be there for downloading.

On the old IRS, locating the file you wanted took a lot of time and effort. So when we were building MagNet, we developed a search utility that's accessible through the system menu. You can track down a specific file by several criteria, including the file extension, the type of utility, and the section of the magazine where the file appeared. And you will be able to download files faster using CompuServe's protocols, in addition to Xmodem and Kermit.

The most exciting new feature of MagNet is its Forums, where you'll be able to communicate directly with *PC Magazine* editors and columnists, as well as with other readers. Discussion and further information about product reviews, columnists' viewpoints, and technical articles will be in reach 24 hours a day.

Productivity section columnists Charles Petzold and Ray Duncan will hold forth on state-of-the-art power programming. You'll be able to share your favorite techniques with them and other readers and to pick up new insights from the running stream of messages in the Forums.

Each of our Viewpoints columnists will have his own MagNet Forum. Jim Seymour, John C. Dvorak, and Stephen Manes will continue to track the issues they tackle in the magazine, and they'll react to readers' opinions right there in the Forum. A variety of *PC Magazine* editors will also be on hand to address your comments on any particular article, whether you want to challenge a finding or find out more about our test results.

The messaging capabilities in the Forums will give MagNet subscribers the chance to ask questions, receive responses, and follow the message thread of a discussion. For example, you could follow a discussion Jim Seymour is having with a number of readers and jump in with your opinion. Of course, you don't have to have anything to say to be a part of the Forum; you can just follow the voice of the crowd, if you like. And there is a chat mode, so you'll be able to communicate directly with anybody who happens to be on-line at the same time.

Another important Forum feature is the ability for readers to upload and share modifications to *PC Magazine* utilities. Over the years, readers have had many innovative suggestions, but the IRS's download-only format didn't permit us to

(continues on page 48)

CompuServe Network Rates vs. AT&T Long Distance to the Interactive Reader Service

PC MagNet can save you money. If you use the CompuServe Network ol local access numbers, you will pay only for your connect lime ol $12.50 per hour for 1,200/2,400-bps service (only $6 for 300), local telephone service, and the CompuServe Network surcharge of $.25 per hour.

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Rates are lor 1,200/2.400-bps service at $12.50 per hour plus the $.25 network surcharge. The AT&T rates (lor Monday through Fnday, 8 A.M. to 5 P. M.) do nol rellect state or local taxes.

Giving PC Magazine a Piece of Your Mind

Do you ever want to give it back to Dvorak? Trade viewpoints with Jim Seymour, or pick the brains of one of *PC Magazine*'s regular contributors? The PC MagNet Forums mirror the magazine's structure and are the place where *PC Magazine*'s editors, writers, and programmers will be found to respond to readers' comments and questions about each issue.

The Forums are moderated by *PC Magazine* editors Mitt Jones, Jonathan Matzkin, and Sal Ricciardi, and the author of the virus-fighting shareware program *Flashot*, Ross Greenberg. If you have a few choice words to describe a *PC Magazine* Editor's Choice, the PC MagNet Forums are the place to make them public.

—Christopher Barr

When you need to move quickly among programs and files, Software Carousel™ carries the load for you.

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–Ralph Evans, Attorney, Fullerton, CA

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–Colin Ralph, Ralph & Panzer, Inc., Seattle, WA

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#6

CIRCLE 333 ON READER SERVICE CARD

PC MagNet

(continued from page 46)

gather them and pass them along.

Each of the Forums has a number of program libraries dedicated to specific topics, with plenty of room for uploads. The Programming Forum has libraries reserved for languages (BASIC, C, Pascal, FORTRAN, and COBOL), Power Programming, and Environments (OS/2). The Tips and Techniques libraries are reserved for your DOS and systems discoveries. There are Forums and program libraries covering all interests, from Spreadsheet Clinic to PC Lab Notes and, of course, Programming/Utilities. Best of all, connect charges are suspended when you upload a file.

There will be open meetings, too. PC MagNet has the ability to host a focus group of subscribers. We'll be inviting industry luminaries to a "convention center"—a live hookup where large numbers of callers can openly challenge and question a featured guest speaker. We have scheduled some of the nation's leading hardware and software developers and experts to join us.

E-mail is the way of the future, and PC MagNet is the fastest method to get information to us. You can send an electronic letter to the editor, by typing it in or by uploading one you've created on your word processor. We can accept submissions to any of our Productivity columns and PC Advisor. Readers will also be able to exchange electronic mail through CompuServe's EasyPlex system.

The surveys we've conducted on the Interactive Reader Service have been an invaluable resource to *PC Magazine* editors and readers. Survey results have been used in planning feature articles and new columns, and they've been published in every issue in Pipeline, here in First Looks, where they've been influencing the vendors who shape product development and providing readers with important information on buying trends and PC issues. PC MagNet surveys will raise the volume on this collective voice.

PC MagNet is designed to be an open-ended system. We're planning to add the full text of *PC Magazine* later this year, enabling readers to locate articles in back issues and search for specific kinds of product reviews. Also in the works is PC MagComm, a new communications software package designed for one thing: communicating with PC MagNet. This package will make it simple for anyone, even inexperienced users, to access the full power of PC MagNet.

PC MagComm will feature innovations like one-button downloads from simple menus and easy navigation of otherwise-complex "threads" of messages in the Forums. PC MagComm will be distributed free of charge at trade shows, at user group meetings, and electronically via PC MagNet and PC-1RS. All updates to PC MagComm will likewise be free of charge and widely distributed. Other exciting features are on the drawing board and will be announced soon.

How to Join PC MagNet

To subscribe, set your communications software to 300 or 1,200 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex. Call one of the numbers listed on the following page. After you've become a member, you may be able to locate a closer telephone access number, or 2,400-bps service, by typing GO PHONES at the ! prompt. (Foreign callers can access PC MagNet through Telenet, TYMNET, or Datapac.)

When you receive a Connect or Carrier Detected message, press Ctrl-C. If you receive a message asking for the host name, enter CIS. At the User ID prompt, enter 177000,5000. Enter PC*MAGNET at the Password prompt, and enter Z10D8810 at the Enter Agreement Number prompt.

Have your credit card handy, either MasterCard, VISA, or American Express, when you register your name and provide billing information. Your personal User ID number and password will be displayed at the end of the subscription process. Please record them in a secure place. A new password will arrive in the mail within 10 days to confirm your subscription. There are no connect charges for PC MagNet during the subscription process.

For communications assistance or if you have difficulty in logging on, call 800-848-8990; in Ohio or outside the United States, call 614-457-8650.

—Christopher Barr

Finding the File You Want on PC MagNet

PC MagNet has nearly 1,000 files available for downloading. Remembering which utility does what can be daunting. Not to worry: we've developed a database you can search to find a particular utility. If you know the filename, say, DR.COM, simply enter it at the Direct Utility Download selection, which will prompt you for the entire name. If you don't know what you are looking for, you can initiate a search using these criteria:

- Type of Utility
- Section of *PC Magazine*
- File Name
- File Extension
- Year Published
- Month Published
- Magazine Cover Date
- Author

Choosing Type of Utility prompts you with the following choices:

- PC Labs Benchmarks
- Programmer's Tools
- Disk
- Spreadsheet
- DOS
- Keyboard
- Video
- Printer
- File
- Desktop
- Shareware
- Index to *PC Magazine*
- User Groups

If, for instance, you choose DOS Utility, PC MagNet will list CO, DR, RN, and a few more for you to choose from. If you choose SELECT SECTION: you can choose from the topic or area you are most interested in:

- PC Lab Notes
- Environments
- Power Programming
- Spreadsheet Clinic
- User-to-User
- Power User
- Languages
- PC Tutor
- Connectivity Clinic
- Utilities
- Features

When you choose from the list of files PC MagNet locates for you, the utility type, author, and publication date will be displayed, along with a short description of the file, the size in bytes, and whether it is an ASCII or binary file. You will be asked if you want to download the file selected, and PC MagNet will estimate the transfer time. **—Christopher Barr**

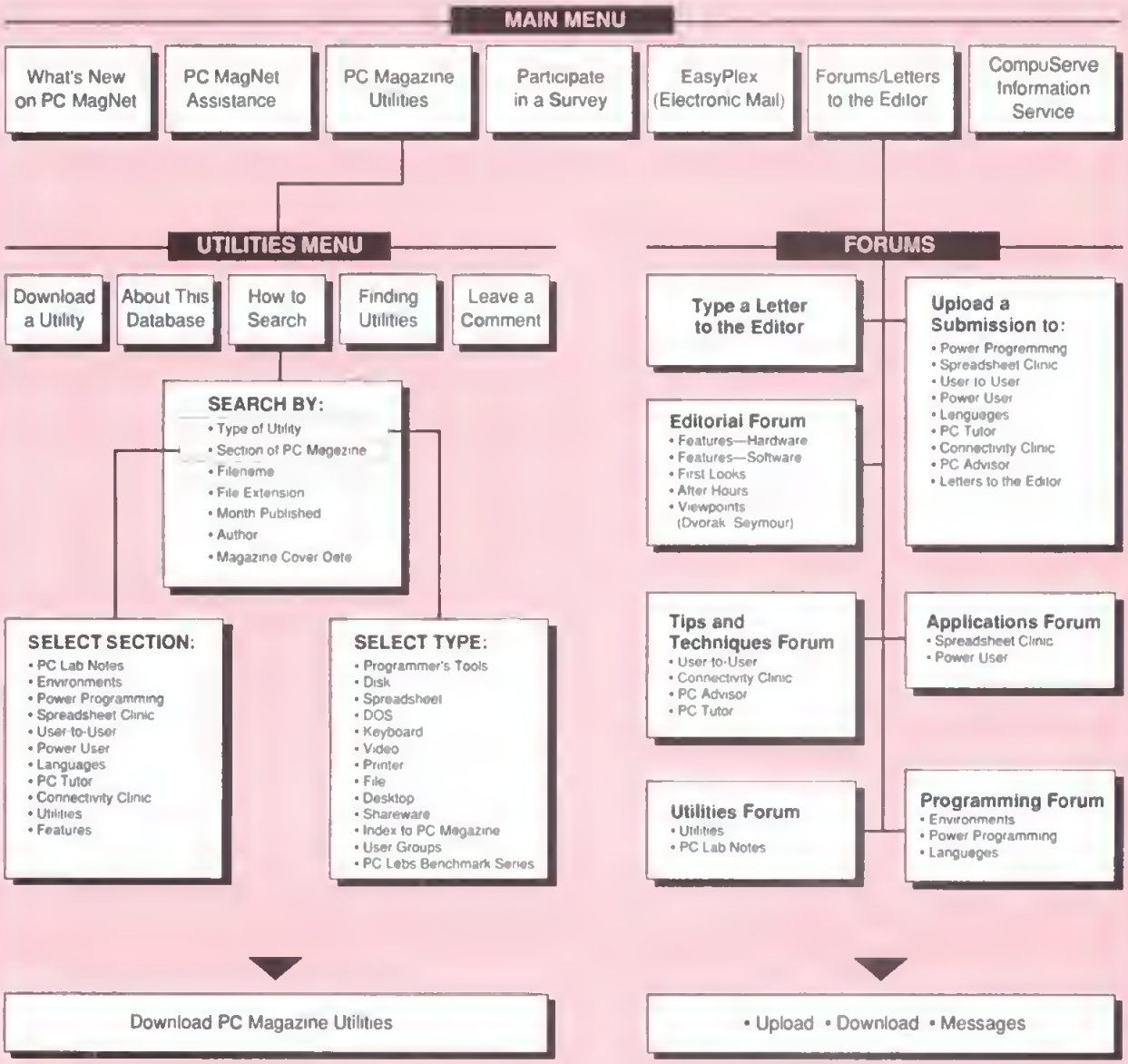
FACT FILE

PC MagNet
Ziff-Davis Publishing Co.
One Park Ave.
New York, NY 10016
(212) 503-5221
List Price: $12.50 per hour.
Requires: PC with 300-, 1,200-, or 2,400-bps modem and communications software.
In Short: *PC Magazine*'s online service featuring free downloads of utilities and the routines published in each issue, discussion forums with the magazine's columnists and editors, and periodic conferences with leading PC developers.

CIRCLE 451 ON READER SERVICE CARD

A Guide to PC MagNet

Where to find the *PC Magazine* utilities, data files, and discussion forums.



To download a *PC Magazine* utility or PC Labs Benchmark Test file, select the Utilities Menu. You can receive a utility by typing the filename, or, if you don't know which utility you want, you can search the utilities database for the file.

The Forums area is the interactive portion of PC MagNet. Here, you can communicate with the editors and writers of *PC Magazine*. You can upload a letter to the editor or submit a program to one of the Productivity columns. In the Forums you can share files with other PC MagNet subscribers and hold discussions with other readers of *PC Magazine*.

Connecting to PC MagNet

Here's a partial directory to PC MagNet's local access numbers for 300- and 1,200-bps modems sorted by area code. Set your modem for 7 data bits, even parity, one stop bit, and full duplex. These numbers will connect you to CompuServe's network. If you don't have a PC MagNet account, follow the directions in the box "How to Join PC MagNet" earlier in this story. If you have a CompuServe account, type GO PCMAGNET at the ! prompt.

Calling PC MagNet from the nearest dialing exchange can dramatically cut your phone costs. If you don't find a number in your dialing exchange here or want to find a number that supports 2,400-bps operation, use the number for the exchange nearest you and, once connected to PC MagNet, type GO PHONES to see a complete listing. This list is sorted by area code and exchange.

PC MagNet can be accessed through alternate communication networks including Telenet, TYMNET, DataPac, Computer Sciences Corp., and LATA Networks. All networks charge a usage premium, and rates and local access numbers are available on-line.

City	State	Phone Number
Morristown	NJ	201 267 0085
Greenbrook	NJ	201 356-0202
Hackensack	NJ	201 368-6300
Ridgewood	NJ	201 444-3913
Newerk	NJ	201 624 6565
Wayne	NJ	201 633-5030
Montclair	NJ	201 783-5400
Hackettstown	NJ	201 852-6502
Woodbridge	NJ	201 906 0980
Washington	DC	202 388 4260
Norwalk	CT	203 222-1748
New London	CT	203 444 2509
New Haven	CT	203 467 3489
Waterbury	CT	203 574-0500
Hertford	CT	203 728-0633
Danbury	CT	203 797 1815
Bridgeport	CT	203 926-0001
Stamford	CT	203 967-4589
Montgomary	AL	205 262-0010
Mobile	AL	205 478-0688
Huntsville	AL	205 536-4405
Tuscaloosa	AL	205 553-1120
Florence	AL	205 766 9925
Birmingham	AL	205 879 2250
Seattle	WA	206 241 9111
Olympia	WA	206 786 6666
Tacoma	WA	206 922 1790
Portland	ME	207 879-0005
Pocatello	ID	208 232-9452
Boise	IO	208 384-5660
Ketchum	IO	208 788-5060
Fresno	CA	209 252-1892
Stockton	CA	209 465-7251
Modesto	CA	209 521 9970
New York	NY	212 422-8820
Culver City	CA	213 390 9617
Torrance	CA	213 542 4311
Long Beach	CA	213 591 6392
Beverly Hills	CA	213 739 0371
Los Angeles	CA	213 739 8906
Dallas	TX	214 953 1971
Norristown	PA	215 279-5811
Reading	PA	215 375-4650
Allentown	PA	215 778 6960
Philadelphia	PA	215 977 9758
Canton	OH	216 455-2518
Ravenna	OH	216 678 5066
Youngstown	OH	216 743 4992
Cleveland	OH	216 771 6860
Akron	OH	216 867-1237
Champaign	IL	217 352 0041
Springfield	IL	217 753-0434
South Bend	IN	219 271 9541
Elkhart	IN	219 293 1593
Ft Wayne	IN	219 447-0510
Gary	IN	219 980 1333
Baltimore	MO	301 254 7113
Annapolis	MO	301 266-7530
Ocean City	MO	301 548 1502
Hyattsville	MD	301 559 6000
Wilmington	OE	302 731-2940
Grand Junction	CO	303 241 1885
Durango	CO	303 259 5880
Ft Collins	CO	303 493 6801
Pueblo	CO	303 546 1891
Colorado Springs	CO	303 596 0910
Boulder	CO	303 629 5563
Longmont	CO	303 651-3207
Loveland	CO	303 663-0992
Dillon	CO	303 668 0991
Aspen	CO	303 925 5892
Glenwood Springs	CO	303 945 0351
Vail	CO	303 949 1336
Wheeling	WV	304 233 9470
Parkersburg	WV	304 485 4225
Huntington	WY	304 733 4010
Charleston	WY	304 768 9700
Miami	FL	305 266 0231
Deerfield Beach	FL	305 428-6104
West Palm Beach	FL	305 684-9051
Ft Leuderdale	FL	305 772-3240
Vero Beach	FL	305 778 0550
Orlando	FL	305 896-4298
Casper	WY	307 234 6914
Cheyenne	WY	307 637-3027
Jackson	WY	307 733-1640
Laremie	WY	307 742-9641
Peoria	IL	309 685-2543
Bloomington	IL	309 827-3343
Chicago	IL	312 693-0330
Aurora	IL	312 859-1557
Lombard	IL	312 953-9660
Flint	MI	313 238 6202
Detroit	MI	313 255-9207
Pontiac	MI	313 334 2900
Troy	MI	313 362 2540
Ann Arbor	MI	313 683-3934
St Louis	MO	314 241-3102
Columbia	MO	314 442-4600
Jefferson City	MO	314 635-9170
Syracuse	NY	315 458 6016
Wichita	KS	318 689 8765
Muncie	IN	317 284 3812
Lafeyette	IN	317 448 1357
Indianapolis	IN	317 638-2762
Richmond	IN	317 935-0061
Lafayette	LA	316 233-1150
Monroe	LA	318 387-0879
Shreveport	LA	318 424 5380
Lake Charles	LA	318 474 0980
Davenport	IA	319 323-7388
Cedar Rapids	IA	319 365 9363
Providence	RI	401 941-8900
Lincoln	NE	402 474-1006
Omaha	NE	402 695 5288
Edmonton	AB	403 466 4501
Atlanta	GA	404 237-3003
Auguste	GA	404 736 8750
Oklahome City	OK	405 946 4860
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Helena	MT	406 449-3680
Monterey	CA	408 375-9931
Santa Cruz	CA	408 478 0422
Salines	CA	408 754-2751
San Jose	CA	408 968-8762
Conroe	TX	409 756 8904
Galveston	TX	409 763-5125
Butler	PA	412 285 8167
Pittsburgh	PA	412 391-8818
Amherst	MA	413 549 7431
Springfield	MA	413 734 7382
Milwaukee	WI	414 258-5616
Green Bay	WI	414 494 0917
Livermore	CA	415 443-9202
Oakland	CA	415 531 1820
Hayward	CA	415 581 2831
San Mateo	CA	415 591-5846
Concord	CA	415 682 2633
San Francisco	CA	415 956-4261
Toronto	ON	418 752-4150
Toledo	OH	419 244-0073
Little Rock	AR	501 224 9311
Louisville	KY	502 581-9526
Portland	OR	503 232 1072
Salem	OR	503 382-2523
Eugene	OR	503 689-9800
Baton Rouge	LA	504 273 0184
New Orleans	LA	504 734 8150
Albuquerque	NM	505 265-1263
Los Alamos	NM	505 662-4122
Spokane	WA	509 326 0515
San Antonio	TX	512 435 3883
Austin	TX	512 444-7234
Laredo	TX	512 722 6008
Corpus Christi	TX	512 882 1465
Dayton	OH	513 461-1064
Cincinnati	OH	513 771-1630
Montreal	PO	514 374 8981
Des Moines	IA	515 270 9410
Hicksville	NY	516 932-1470
Lansing	MI	517 321-2368
Saginew	MI	517 893-1181
Albany	NY	518 439-7491
Jackson	MS	601 948 6411
Phoenix	AZ	602 256-2951
Tucson	AZ	602 748-2009
Yuma	AZ	602 782 7191
Nashua	NH	603 883 5551
Vancouver	BC	604 738 5157
Rapid City	SO	605 341 3733
Lexington	KY	606 259-3446
Ithaca	NY	607 257-0155
Binghamton	NY	607 724-1171
Madison	WI	608 256 6525
Camden	NJ	609 665-7555
Princeton	NJ	609 921-7066
Minneapolis	MN	612 342-2207
Cambridge	OH	614 439-7380
Grenville	OH	614 587-0932
Athens	OH	614 592-2109
Columbus	OH	614 876-2118
Neshville	TN	615 366-1947
Getlinburg	TN	615 436-2001
Oak Ridge	TN	615 483-2292
Knoxville	TN	615 522 0164
Chattanooga	TN	615 877 5804
Johnson City	TN	615 928-2431
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Grand Rapids	MI	616 957-3368
Westboro	MA	617 366-2617
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Groton	MA	617 448-9301
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Reno	NV	702 323-4426
Las Vegas	NV	702 737-8883
Alexendna	VA	703 352-7500
Roenoke	VA	703 563-8421
Alexendne	VA	703 841-9834
Asheville	NC	704 274 3991
Charlotte	NC	704 333-6854
Napa	CA	707 257-7710
Santa Rose	CA	707 579-1490
Houston	TX	713 462-0202
Riverside	CA	714 359-7801
Anaheim	CA	714 520-9724
Newport Beach	CA	714 851-0145
Pomone	CA	714 865 2229
San Bernerdino	CA	714 881-1583
Rochester	NY	716 458-3460
Buffalo	NY	716 874-3751
Hemsburg	PA	717 857-9633
York	PA	717 845 7631
Provo	UT	601 377-1120
Salt Lake City	UT	801 521-2890
Burlington	VT	802 862-1575
Myrtle Beach	SC	803 238-8625
Greenville	SC	803 255-4686
Spartenburg	SC	803 585 9611
Cherleston	SC	803 763 0090
Columbia	SC	803 763 5484
Norfolk	VA	804 461-8187
Hampton	VA	804 722-0016
Richmond	VA	804 741-0158
Williamsburg	VA	804 688-0555
Charlottesville	VA	604 979-5159
Bakersfield	CA	605 323-7691
Thousand Oaks	CA	805 499-0371
San Luis Obispo	CA	605 549-8605
Ventura	CA	605 643 0177
Santa Barbara	CA	605 682 2331
Oxnerd	CA	605 984-6892
Amerillo	TX	806 379 8411
Lubbock	TX	806 763 5081
Maui	HI	808 244-9152
Kailua	HI	808 263-6670
San Juan	PR	809 728-3012
Evansville	IN	812 479-0185
Tampa	FL	813 237-8189
Winter Haven	FL	813 299 3311
Sarasota	FL	813 351-7702
Saresote	FL	813 355-9331
St Petersburg	FL	813 525-0378
Ft Myers	FL	813 939-7060
Erie	PA	814 453-7538
Kanses City	MO	816 474-3770
Ft Worth	TX	817 283-0041
N Hollywood	CA	818 763 0558
Ven Nuys	CA	616 902 0932
Memphis	TN	901 452-1710
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Tallahassee	FL	904 385-0590
Jacksonville	FL	904 396-7105
Pensecola	FL	904 434-3911
Paname City	FL	904 671-0680
Fairbanks	AK	907 479-4102
Anchorage	AK	907 563 8425
Savennah	GA	912 355-0222
Albany	GA	912 435-9420
Topeka	KS	913 234-1051
Middletown	NY	914 344-3800
Poughkeepsie	NY	914 473-2617
White Plains	NY	914 761 9360
El Paso	TX	915 565-4661
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So Lake Tahoe	CA	916 541-5940
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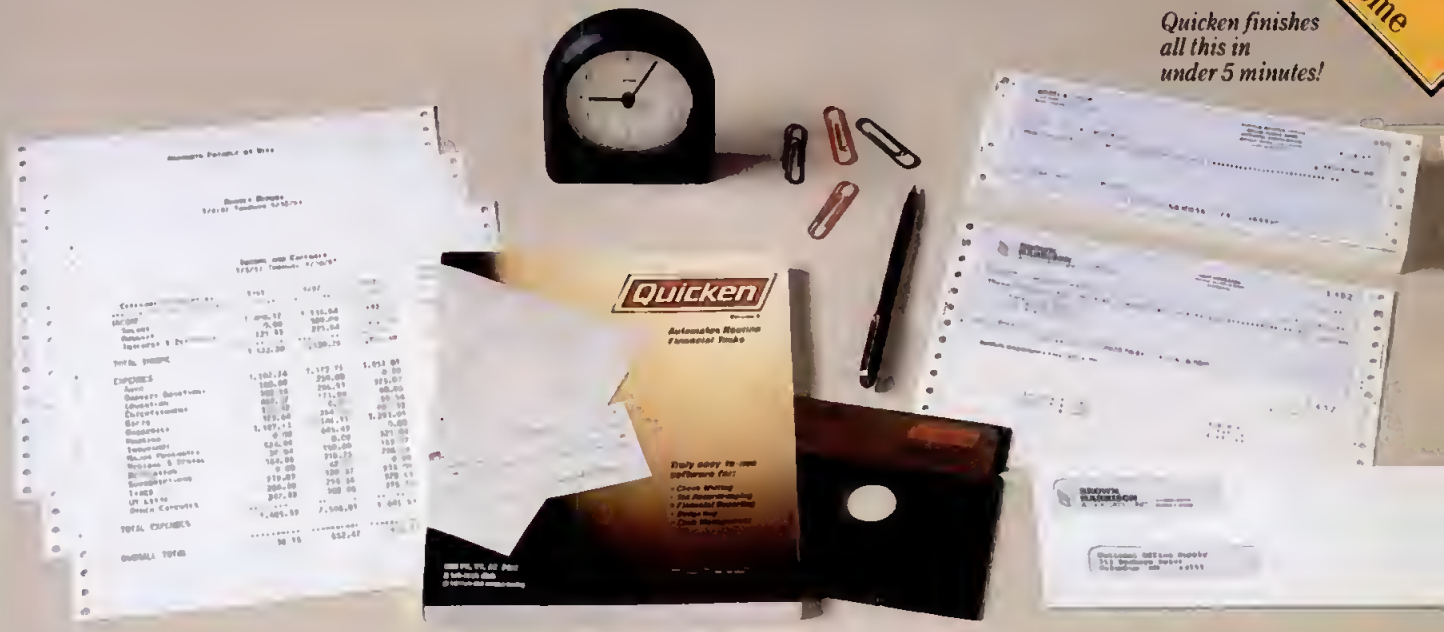

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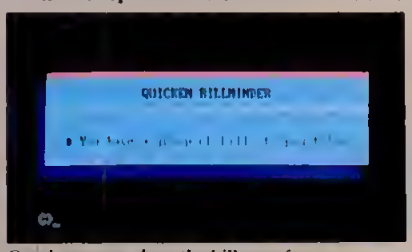

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Model 386-6 20MHz

Truly one of the fastest 386 computers on the market. Even faster than the Compaq 386/20. Includes high speed SCSI Interface on the motherboard.

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- Accepts 80387 Running at 20MHz.
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- AT and OS/2 Compatibility.
- 200 Watt Power Supply
- 80287 or 80387 Coprocessor.
- 1 - 32 Bit Slot

20MHz Model 386-5 with Intel 20MHz 80386

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One of the lowest priced 20MHz models available.

- 80386 Running at 20MHz and 0 Wait State
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- 1MB of 0 Wait State Ram
- 101 Enhenced Keyboard
- Western Digital 2F-2H Controller
- 1.2MB Floppy Disk Drive
- AT and OS/2 Compatibility
- 200 Watt Power Supply
- 80287 or 80387 Coprocessor
- 1 - 32 Bit Slot

Model 286-1 12MHz

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- Speed Selectable for 6/12MHz
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- AT and OS/2 Compatibility.
- 200 Watt Power Supply.
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- Up to 16MB available
- 101 Enhanced Keyboard
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CIRCLE 390 ON READER SERVICE CARD

NEW ON THE MARKET

by Michael W. Muchmore

Two Companies Unveil Ethernet LAN Adapters For the Micro Channel

Tiara Computer Systems and **Localnet Communications** have announced Micro Channel-compatible Ethernet LAN adapter cards for PS/2 Models 50, 60, and 80.

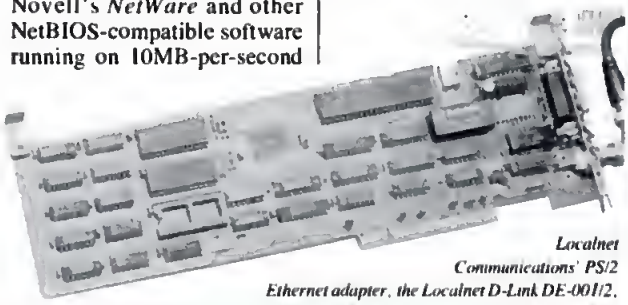
Both are compatible with Novell's *NetWare* and other NetBIOS-compatible software running on 10MB-per-second Ethernet LANs, and both provide remote boot capability.

Tiara's $725 LanCard E-II incorporates I/O mapping, an Ethernet interface chip from Fujitsu, and an MCA interface from Chips and Technologies, making it 15 percent faster than cards based on other technologies, according to Tiara.

Localnet's $495 D-Link DE-001/2 uses VLSI chips from National Semiconductor to reduce the number of components and power consumption.

List Price: Tiara LanCard E-II, $725. **Requires:** PS/2 Model 50, 60, or 80; NetBIOS-compatible networking software, Ethernet cabling, DOS 3.1 or later. Tiara Computer Systems, 2700 Garcia Ave., Mountain View, CA 94043; (415) 965-1700.

CIRCLE **442** ON READER SERVICE CARD



Localnet Communications' PS/2 Ethernet adapter, the Localnet D-Link DE-001/2, uses VLSI chips from National Semiconductor to cut power consumption.

Tiara Computer Systems' $725 Tiara LanCard E-II enables you to use IBM PS/2 Models 50, 60, and 80 on an Ethernet local area network.

List Price: Localnet D-Link DE-001/2, $495; *LANsmart*, $395. **Requires:** Localnet D-Link DE-001/2: PS/2 Model 50, 60, or 80; NetBIOS-compatible networking software, Ethernet cabling, DOS 3.1 or later. *LANsmart*: 512K RAM (640K recommended), one disk drive, DOS 3.1 or later. Localnet Communications Inc., 3303 Harbor Blvd., #E-8, Costa Mesa, CA 92626; (714) 549-7942.

CIRCLE **444** ON READER SERVICE CARD

Liquid Crystal Supplants the Laser in Data Technology's CrystalPrint Pageprinters

Data Technology's CrystalPrint WP and CrystalPrint Series II LCD printers provide laser-quality resolution, speed, and HP compatibility without the use of laser technology.

The CrystalPrint machines are based on a Casio print engine that uses liquid crystal shutter technology.

The $1,299 CrystalPrint WP emulates the Diablo 630, and the CrystalPrint Series II ($1,999) offers HP LaserJet series II emulation. The printers are about half the size of LaserJets (15.7 by 13.4 by 9.1 inches) and print at a rate of 6 pages per minute.

LaserJet Plus or Epson FX-80 emulation ($79 each) are available for the WP. The emulations require an upgrade of the WP's 128K controller to 256K ($169). Both machines accept Data Technology's proprietary Bitstream font cartridges for use with the series II, or the WP with LaserJet Plus option. The cartridges also supply IBM Proprinter emulation.

List Price: CrystalPrint WP, $1,299; CrystalPrint Series II, $1,999. Data Technology Corp., 2551 Walsh Ave., Santa Clara, CA 95051; (408) 727-8899.

CIRCLE **437** ON READER SERVICE CARD

Data Technology's $1,999 CrystalPrint Series II offers HP LaserJet series II compatibility and uses LCDs in place of lasers to form images.

Sony Plans to Market Two CD-ROM Drives: CDU-510, CDU-7101

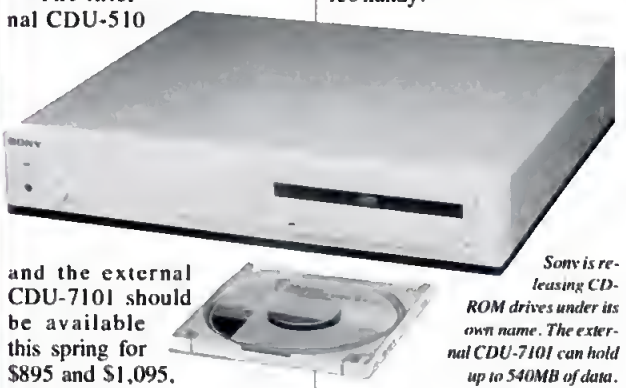
CD-ROM drives made by **Sony** have been available under other company labels for several months, but now the electronics giant's Computer Peripherals Division plans to sell two drives under the Sony name.

The internal CDU-510 and the external CDU-7101 should be available this spring for $895 and $1,095, respectively.

Both drives average ½-second access times and data transfer rates of 150K per second (sustained) and 600K per second (burst). They feature layered error correction circuitry.

The optical head locks automatically when the 540MB media is removed, and disk loading and ejection is automatic.

Sony supplies the PC interface, connecting cable, and a CD-ROM extension to DOS. The CDU-510 measures 1⅝ by 8 by 5¾ inches (HWD), and the CDU-7101 is 2⅜ by 14 by 12⅝ inches. The external model also plays music CDs, so have a stereo handy.

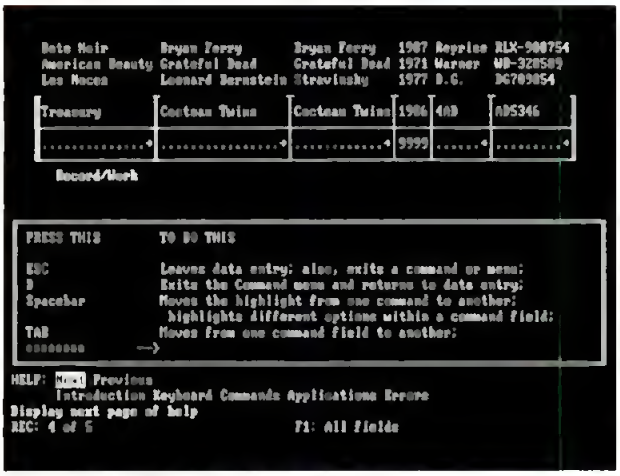


Sony is releasing CD-ROM drives under its own name. The external CDU-7101 can hold up to 540MB of data.

List Price: CDU-510, $895; CDU-7101, $1,095. Sony Corp. of America, Computer Peripherals Division, 1 Sony Dr., Park Ridge, NJ 07656; (201) 930-6585.

CIRCLE **440** ON READER SERVICE CARD

NEW ON THE MARKET



Tools & Techniques' $149 DataPlex *is a user interface for entering data into different databases and spreadsheets, and can translate data between them.*

DataPlex Furnishes a Friendly Front End for dBASE, 1-2-3, ASCII

Tools & Techniques has introduced *DataPlex*, a $149 data entry and translation package. The company says its software can directly interconvert *dBASE*, *Lotus 1-2-3*, *Symphany*, *VP Infa*, *FoxBASE*, *The Twin*, *VP Planner*, and ASCII files.

T & T says *DataPlex* provides a consistent interface that allows even a relatively untrained user to enter data in a variety of applications. It automatically adjusts field widths and alignment and automatically provides edit rules and macros to speed repetitive entries. Data can be handled at four levels: record, view, field, and subfield.

The entry area is always at the upper middle area of the screen, and a message window occupies the lower middle. The bottom of the screen contains the *DataPlex* menu.

List Price: *DataPlex*, $149. **Requires:** 384K RAM, two disk drives, DOS 2.0 or later. Not copy protected. Tools & Techniques Inc., 1620 W. 12th, Austin, TX 78703; (512) 482-0824.

CIRCLE **441** ON READER SERVICE CARD

HOT PROSPECT

Migent Proclaims Emerald Bay As the Next Generation Database

Microsoft, Lotus, Oracle, and others have announced multiuser SQL databases, but most won't ship until the second half of '88. **Migent**, on the other hand, claims an April delivery for *Emerald Bay*, the brainchild of *dBASE II* developer Wayne Ratliff.

In its initial release, Emerald Bay is made up of four components. The *Database Server* software is a $695 NetBIOS LAN manager that also provides security and data integrity. It is complemented by Eagle, a $495 multiuser *dBASE* programming language. Migent will also offer a $495 C language developer's toolkit. *Summit*, a $195 *Lotus 1-2-3* add-in, lets you use database data in spreadsheets. *Summit* is the first end-user Emerald Bay application.

Migent won't charge royalties for applications developed using *Emerald Bay* technology. **List Price:** *Emerald Bay Database Server*, $695; Eagle, $495; Developer's Toolkit for C, $495; *Summit*, $195. **Requires:** 640K RAM, DOS 3.1 or later. Hard disk drive recommended. Not copy protected. Migent Inc., 865 Tahoe Blvd., P.O. Box 6062, Incline Village, NV 89450-6062; (702) 832-3700.

CIRCLE **436** ON READER SERVICE CARD

Radio Shack Premieres a SCSI Adapter, Hard Disk Drive for AT-class Machines

Radio Shack Division of **Tandy Corp.** claims to have the first SCSI (Small Computer System Interface, pronounced "scuzzy") 16-bit adapter for AT-class PCs. The company is also offering a SCSI-compatible 80MB hard disk drive for use with the adapter.

SCSI is a standard interface used in minicomputers and Apple Macintoshes.

The $299.95 Tandy SCSI supports up to three storage devices of capacities from 40MB to 768MB. It features a 10-MHz, 16-bit DMA (direct memory access) chip. Its data transfer rate can reach 10MB per second, and it works in 80386- as well as 80286-based machines.

Tandy plans to add SCSI support for peripherals and support for the OS/2 operating environments in the future.

List Price: Tandy SCSI Adapter (cat. #25-4161), $299.95; Tandy 80MB SCSI Hard Disk Drive (cat. #25-4160), $1,799. Radio Shack Division of Tandy Corp.; inquire at Radio Shack Computer Centers.

CIRCLE **438** ON READER SERVICE CARD

Simplifier Smoothes The Learning Curve in Popular Applications

Eric Bromley, the inventor of Pac Man, Mr. Do, and Frogger, is venturing into the business market with an alternate input device designed to help neophytes learn *Lotus 1-2-3*, *WordPerfect*, and other application software.

The Simplifier is a separate function-button console that plugs into the PC's keyboard port. Its keys are configured to issue commands for specific application programs. Plug-in cartridges configure the Simplifier for individual applications like *Lotus 1-2-3* and *MultiMate Advantage*.

A Learn mode teaches users by showing the appropriate keypresses on an LCD instruction line.

A PS/2 adapter and independent power supply are included. **List Price:** Penguin Simplifier, $599.95; Cartridges (*Lotus 1-2-3*, *MultiMate Advantage*, *dBASE III*, *Microsoft Word*, *DisplayWrite 4*, *WordPerfect* available), $79.95. Penguin Products Inc., 5 Old Windsor Rd., Bloomfield, CT 06002; (203) 243-8434.

CIRCLE **443** ON READER SERVICE CARD

The Penguin Simplifier creates macros automatically and teaches inexperienced users how to operate popular business software.

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LAP-LINK LAP-LINK transfers files between IBM and compatibles, laptops and desktops including the IBM PS/2. It installs in seconds, offers a split screen design, showing files in both computers, and can transfer them at incredible speeds of up to 115,200 baud. LAP-LINK comes complete with diskettes, documentation and a universal cable.

LAP-LINK received PC Magazine's Editor's Choice and "Best of '87" awards.

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Traveling Software

CIRCLE 222 ON READER SERVICE CARD

Traveling Software • 19310 North Creek Parkway • Bothell, WA 98011

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DataLift Data Entry Utility Cleans Up Files and Speeds Throughput

PC HANDS ON

BY GENE SMILGIEWICZ

DataLift, from Peoplesmith, is a unique product that can improve the appearance and uniformity of your data. Though optimized to handle mailing lists in *dBASE III* format, *DataLift* is versatile enough to improve data entry throughput and integrity for other types of lists and storage formats, too.

DataLift is a standalone utility meant to process files after data entry is done. It reduces the number of keystrokes needed to input character fields by allowing you to enter them in a "down and dirty" fashiun—all upperease with minimal punctuation and many abbreviations. When you're done pounding in your data, *DataLift* processes your data file, rapidly expanding and refining your entries according to rules you specify, utilizing lookup tables to supply abbreviation corollaries and fill in gaps.

Let's look at some examples of how *DataLift* can save keystrokes. To enter "MR GEORGE SMITH JR" into a name field with the CapsLock key would require 18 keystrokes. "Mr. George Smith, Jr." would require 29 (with the shift to/from upperease counting as two keystrokes). Using only abbreviations, entering "DP MGR" into a title field and "GE" into a company field would require only eight keystrokes. "Data Processing Manager" and "General Electric", on the other hand, would require 49.

These three fields alnne require 78 keystrokes for proper entry instead of the 26 that are actually needed for *DataLift* to produce the same results. Similar savings could also accrue in address, department, and city type fields. Multiply this by a few hundred or thousand records, factor in a decreased error rate (fewer keystrokes mean fewer errors), and yuu have got some significant savings in keystrokes *and* operator wear and tear.

Peoplesmith's throughput claims would be poppycock if *DataLift* users had to spend all the time they save during data entry to do conversions. Fortunately, it does its job quickly and efficiently. I processed seven fields in a 250K file composed of 1,100 records in less than 5 minutes. The program's well-crafted user interface and context-sensitive help reduce the learning curve to a gentle slope so you can become productive in no time flat.

Peoplesmith has rounded up the usual suspects in its lookup tables to start you off with the mnst frequently used abbreviations and conversion patterns. All you have to do is select a file, choose a casing option (cunvert to upper/lower, force to upper, leave unchanged), pick the fields to convert, identify each field's "mode," then issue a "GO" command to start the program rolling.

Field modality enables *DataLift* to apply parsing logic appropriate to the field being converted as well as activating the correct lookup file during conversion. This expedites processing of prefix, first name, last name, suffix, full name, inverse name, department/title, cumpany, street/address, city-/town, and custom fields. An added benefit is that you never have to convert an entire record—just the fields you select.

The Lookup Table Editor allows you to easily add, change, and print abbreviations and their expanded forms for each field mode. Additional utilities provide a database browse/edit mode as well as ASCII import and export facilities to handle data stored in non-*dBASE* file formats.

DataLift does more than polish mailing-list field entries, however. Its seareh-and-replace utility is wonderful for changing parts of long character fields in any type of list. Its "custom field" mode provides the means to effect shortcuts for almost any type of specialized application.

DataLift does its job so well that I can only complain about what it does not do. Its major omission is an option to print a simple columnar report or mailing labels. Almost as bad is the inability to save conversion specifications in a file that can be used repetitively. (Peoplesmith intends to include hard copy and spec storage options in the next release.) It would also be nice to be able to work on *Lotus 1-2-3* files directly instead of having to deal with intermediate ASCII files.

This is the kind of product that can pay for itself after one session. If you ever had to "clean up" a mailing list manually, especially one based on downloaded mainframe data, you'll appreciate the time (and money) *DataLift* can save. Any company or individual concerned about the look nf correspondence should try it out.

This display of conversions can be suppressed for faster processing. Notice how DataLift *substitutes correct abbreviations if their expansions won't fit into a field.*

> Peoplesmith's throughput claims would be poppycock if *DataLift* users had to spend all the time they save during data entry to do conversions. Fortunately, it does its job quickly and efficiently.

PC MAGAZINE FACT FILE

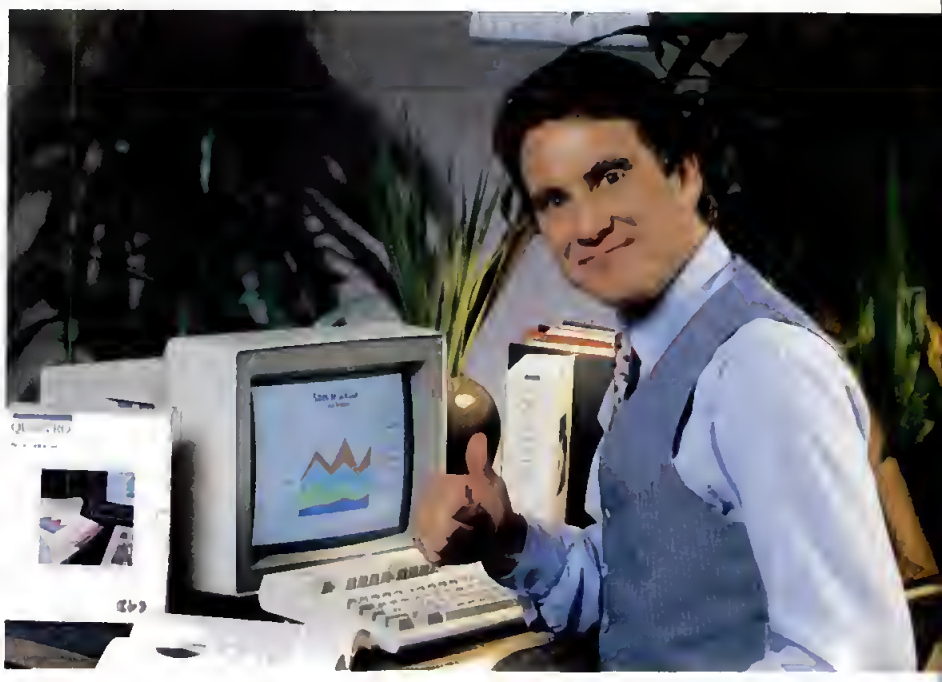
***DataLift*, Version 2.1**
Peoplesmith Inc.
18 Damon Rd.
P.O. Box 384
North Scituate, MA 02060
(617) 545-7300
List Price: $69.95; free upgrade from Version 2.0.
Requires: 410K RAM, hard disk recommended, DOS 2.0 or later.
In Short: An efficient data entry utitity that increases throughput and refines case and punctuation of character fields. Not copy protected.

CIRCLE 431 ON READER SERVICE CARD

Quattro: The Professional Spreadsheet, for people who'd rather switch than fight

The switch is on. People and companies are switching from 1-2-3® to Quattro™ because they'd rather switch than fight the problems, complications, limitations, and extra expense of 1-2-3.

Spreadsheet users are seeing what they get right now with Quattro for only $247.50 and are realizing that to go the 1-2-3 route they'll find themselves paying $495 for it, then adding Lotus Learn,™ Lotus Speedup,™ and Lotus HAL® ($150), which means $645.00 or nearly $400 more than Quattro. *Ouch!* to either your wallet or the company's budget. Why do it?



They're switching to Quattro because it doesn't waste time

Quattro's intelligent recalc means that it only recalculates affected cells instead of recalculating every cell the way 1-2-3 does it (unless, you've added their Speedup). Time counts too—and if you want to save yours—switch to Quattro.

There's everything to gain and nothing to lose

If you already know a lot about 1-2-3, you already know a lot about Quattro. You're not faced with learning a new program because Quattro can be made to respond to commands like 1-2-3, but with much better, faster results.

You not only bring your 1-2-3 knowledge to Quattro, you also bring your 1-2-3 *files* to Quattro. Quattro understands them and lets you continue to work with them—and easily produce presentation-quality results.

Switching to Quattro means you're not in a holding pattern waiting for the much-announced but never-delivered 1-2-3 Version 3.0. Quattro lets you act now.

Switching to Quattro means you avoid lengthy and complicated 1-2-3 installation procedures. Quattro senses the kind of hardware you have and installs itself automatically.

Quattro includes SQZ!® Plus data compression

A special implementation of SQZ! Plus, the spreadsheet file compression utility, is built into Quattro and comes to you absolutely free! SQZ! Plus for Quattro automatically compacts and expands Quattro spreadsheets by up to 95% during file saving and retrieving.

It's easy to learn and it's easy to switch

Quattro is easy to learn, whether you're just starting with your first spreadsheet or you're switching from 1-2-3. It's only $247.50 and, because it's from Borland, it has a 60-day money-back guarantee.* You'll enjoy the switch to Quattro. Why fight it?

Includes both 5¼" and 3½" diskettes

"Quattro offers great control over graphs—now users don't have to go to a separate package to create business presentation graphics."

Steve Owens, Price Waterhouse

"With Lotus 1-2-3, I had to use a third-party program to annotate the graphs . . . I wasted a lot of time . . . But with Quattro, annotation and printing is integrated."

Bill Todd, Siemens GammaSonics, Inc.

"I find recalculation speed with Quattro to be more than twice as fast as with Lotus 1-2-3."

Doug Cobb, President, The Cobb Group, Inc.

Those who are considering purchasing 1-2-3 will be better off with Quattro.

John Walkenbach, InfoWorld "

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BORLAND

CIRCLE 377 ON READER SERVICE CARD

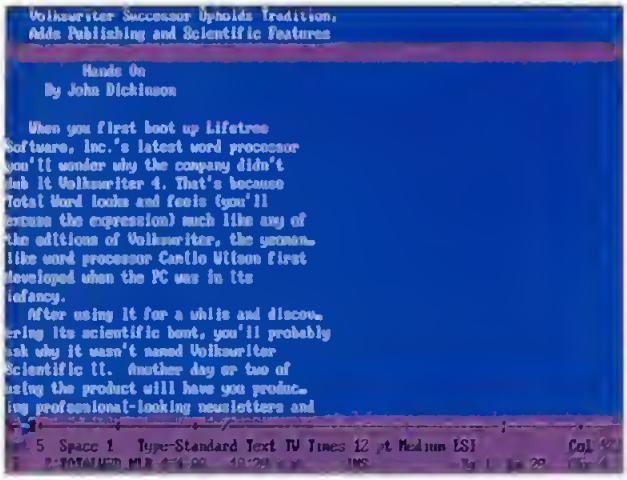
Volkswriter Successor Upholds Tradition, Adds Publishing and Scientific Features

HANDS ON

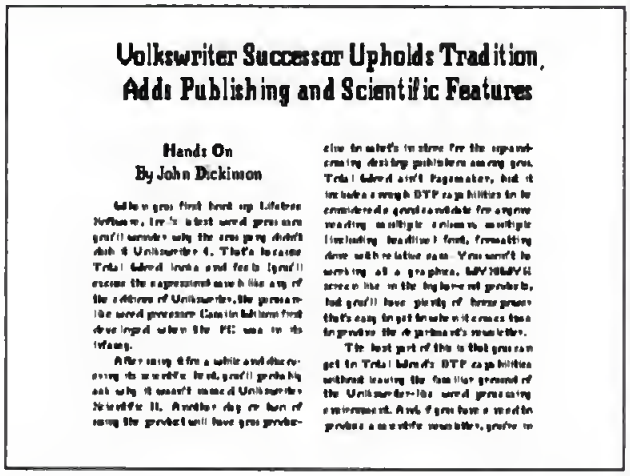
BY JOHN DICKINSON

When you first boot up Lifetree Software's latest word processor, you'll wonder why the company didn't dub it *Volkswriter 4*. That's because *Total Word* looks and feels much like any of the editions of *Volkswriter*, the yeoman word processor Camilo Wilson first developed when the PC was in its infancy.

After using it for a while and discovering its scientific bent, you'll probably ask why it wasn't named *Volkswriter Scientific II*. Another day or two of using the product will have you producing professional-looking newsletters and will make you absolutely certain it should have been called *Volkspublisher*.



Total Word's status line (top) shows type style and size in addition to other settings. The fonts are not particularly accurate, or even pretty, in Total Word's *page preview program (bottom), but the program does make up for the lack of a WYSIWYG screen when you are putting a newsletter or scientific paper together and want to avoid printing things out every time you make a small change.*


Volkswriter Successor Upholds Tradition,
Adds Publishing and Scientific Features

Hands On
By John Dickinson

Rather than give it all three names, Lifetree's marketing folks decided to call their latest entry into the PC software game *Total Word*, which, if nothing else, accurately reflects this product's multiple talents and personalities. If you've liked writing with *Volkswriter*, you'll just love using *Total Word*. And if you haven't tried—or liked—*Volkswriter*, don't consider that grounds for writing off *Total Word*.

Like its *Volkswriter* predecessors, *Total Word* is competent at office-grade word processing. It is basic and simple to use, yet includes such snappy features as automatic hyphenation, a built-in thesaurus, and style sheets.

For scientific writers, *Total Word* is a vast improvement over *Volkswriter Scientific*, which always seemed to me to be unnecessarily difficult to use. *Total Word* lets you easily access nine special keyboards containing all the scientific and chemical notation you could want, along with a superset of IBM's block graphics character set. Those special keyboards also include easy access to a superset of the European language character set found in the IBM high-order character set. You can also import graphics, which makes for a better scientific word processor and helps the rest of *Total Word* do its job better.

The block graphics characters are a clue to what's in store for up-and-coming desktop publishers. *Total Word* ain't *PageMaker*, but it includes enough DTP capabilities to be considered a good candidate for anyone needing multiple-column, multiple-font (including headline) formatting done with relative ease. You won't be working at the kind of WYSIWYG screen you get in the higher-end products, but you'll have plenty of horsepower that's easy to get to when it comes time to produce the department's newsletter.

The best part of this is that you can get to *Total Word*'s DTP capabilities without leaving the familiar ground of the *Volkswriter*-like word processing environment. And if you need to produce a scientific newsletter, you're in great shape because all of those *Total Word* capabilities also work in its DTP environment.

One of the things *Total Word* does very well is print using downloaded fonts and a laser printer, such as the Hewlett-Packard LaserJet. The product comes equipped with its own fonts—including large and small headlines sufficient for small DTP jobs—and you can add your own at a later time. *Total Word*'s page preview function, on the other hand, leaves something to be desired. The fonts used are nearly illegible—both in full-page and close-up modes—and navigation is very limited.

On most counts, however, *Total Word* is unique and uniquely useful, especially to the serious general or scientific word processing user just ready to branch into DTP. It's got more than enough features for upscale word processing, and plenty to get you going in the DTP arena.

FACT FILE

Total Word
Lifetree Software Inc.
411 Pacific St.
Monterey, CA 93940
(408) 373-4718
List Price: $495; *Volkswriter 3* users can upgrade for $99, and *Volkswriter Scientific* and earlier-edition *Volkswriter* users can upgrade for $149.
In Short: *Total Word* has multiple talents—standard text processing, scientific word processing, and desktop publishing. And it's good at what it does, making it an easy choice for any office's total word processing environment.

CIRCLE 434 ON READER SERVICE CARD

"Behind the beauty of the Turbo C environment stands the brawn of a full-fledged compiler"

Marty Franz, PC Tech Journal

"Taking compilers and program development tools into the next generation is Borland International's Turbo C, a $99.95 package that will stun you with in-RAM compilations that operate at warp speed.

. . . a 21st century compiler at a preinflation 1967 price. Is it any wonder that Turbo C was included in the Best of 1987?

Richard Hale Shaw, PC Magazine

Turbo C represents an all-new price-performance level—one that will be hard to match, much less beat.

Stephen Randy Davis, PC Magazine

Turbo C showed excellent compiler speeds, good overall benchmark scores, and extraordinary floating-point performance.

Scott Robert Ladd, Micro Cornucopia"

Actual photograph of Turbo C graphics displayed on IBM 8514 screen.*

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- Context-sensitive help for the language and the library routines
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- 43- and 50-line mode support
- VGA, CGA, EGA, Hercules, and IBM 8514 support
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- More than 100 new functions

The professional optimizing compiler for less than $100.00

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BORLAND INTERNATIONAL

***Minimum system requirements:** For the IBM PS/2™ and the IBM® family of personal computers and all 100% compatibles. PC-DOS (MS-DOS®) 2.0 or later. 384K

*Artwork metafile courtesy of Genigraphics® Corporation

**Customer satisfaction is our main concern. If within 60 days of purchase this product does not perform in accordance with our claims, call our customer service department, and we will arrange a refund.

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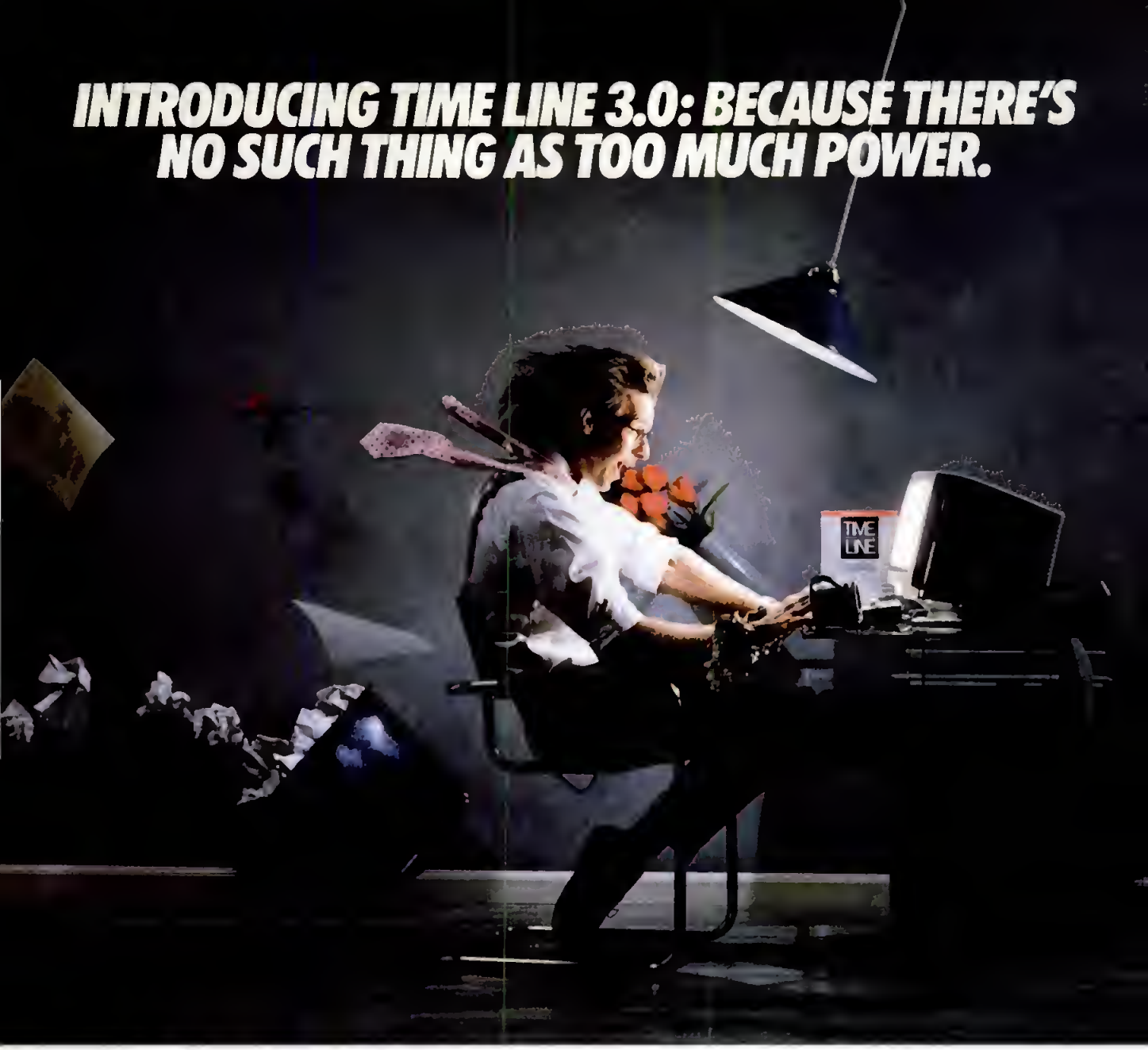
BI 1221

CIRCLE 137 ON READER SERVICE CARD

INTRODUCING TIME LINE 3.0: BECAUSE THERE'S NO SUCH THING AS TOO MUCH POWER.



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- Baseline tracking produces Actual vs. Plan Gantt. Cost tracking records "actuals" and percent complete.
- Supports government reporting requirements (C/SSR). Calculates earned value and supports WBS and OBS numbers.
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Hundreds of enhancements, easy to navigate outlining... technology so advanced there are patents pending. Call (800) 888-0886 Ext. 190P for a FREE demo disk (a $9.95 value) or FREE corporate evaluation. Time Line 3.0: the power will blow you away.

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Breakthrough Software Division

**Time Line 2.0, PC Magazine Editor's Choice 1986 & 1987; rated #1 by Software Digest 1987. Time Line 2.0 ($495) is the best choice for laptops or PCs without hard disks or with <640K RAM. Time Line 2.0 owners call (415) 963-4440 for low-cost upgrade (offer expires May 31, 1988 so hurry). Training and consulting services available, call (415) 898-1919. †ThinkTank, the original outline processor from the Living Videotext Division. © 1988 Symantec, 10201 Torre Ave., Cupertino, CA, (408) 253-9600.*

CIRCLE 249 ON READER SERVICE CARD

PC UPDATE

edited by Peggy Gavan

GRiD Introduces High-Contrast, Supertwist LCD

GRiD Systems has introduced a high-contrast, supertwist liquid crystal display for its **1500 Series** and other AT-compatible laptops. The new display—a transmissive, backlit LCD with 12-to-1 contrast and 640 by 400 resolution—is priced at $295. GRiD Systems, Fremont, Calif.; (415) 656-4700.

WordPerfect Offers Free Fontware Installation Kit and Fonts

WordPerfect Corp. is offering its ***WordPerfect 5.0*** customers Bitstream's ***Fontware Installation Kit for WordPerfect*** and nine Bitstream fonts at no charge, a value of $500. The free fonts included are Dutch and Swiss (Times Roman and Helvetica) in roman, italic, bold, and bold italic, and Bitstream Charter. Users should call (800) 222-9409 to request the free kit and fonts. WordPerfect Corp., Orem, Utah; (801) 225-5000.

Peachtree Offers Timeslips with Accounting Software

For a limited time, Peachtree Software is marketing its ***Peachtree Complete II*** accounting program with North Edge Software's ***Timeslips III*** time and billing system at a reduced rate of $398. In addition, all customers who purchase the combination package will receive the ***Timeslips Accounting Link (TAL)*** interface free of charge. Peachtree Software, Norcross, Ga.; (800) 247-3224.

AT&T 6300 Joins Family Of WorkGroup Systems

AT&T has introduced the **6300 WorkGroup System**, the newest addition in its line of WorkGroup System PCs. The base model, priced at $1,411, features a 10-MHz Intel 8086 microprocessor, 640K RAM, one 360K floppy drive, seven expansion slots, and one serial and parallel port. A dual-floppy version is available for $1,491, and a 20MB hard disk model is priced at $2,091. AT&T, Morristown, N.J.; (800) 247-1212.

The AT&T 6300 WorkGroup System features a 10-MHz 8086 microprocessor and 640K RAM.

Racal-Vadic Adds Data Compression to 2400VP Modem

Racal-Vadic's upgraded **2400VP** full-duplex modem, available in July for $595, will offer MNP Classes 4 and 5 data compression. Customers who purchased the 2400VP after April 1

Racal-Vadic's upgraded 2400VP modem now offers MNP Classes 4 and 5 data compression

will receive upgrade kits for free; others will be charged $50. Racal-Vadic, Milpitas, Calif.; (408) 432-8008.

Bitstream Enhances Fontware Installation Kit for Windows 1.03 and 2.0

Bitstream has announced Release 2.0 of the ***Fontware Installation Kit for Microsoft Windows***. Release 2.0 adds support for *Windows*, Versions 1.03 and 2.0 or later, and has several enhancements, including an extended range of point sizes and support for HP LaserJet and PostScript PDL printers. Registered users who purchased Release 1.0 on or after March 8, 1988, are eligible for free upgrades; upgrades are $30 for all other users. Bitstream, Cambridge, Mass.; (617) 497-6222.

IN BRIEF

Migent has reduced the price of its **Migent Pocket Modem** by $100, from $259 to $159. Migent, Incline Village, Nev.; (702) 832-3700 . . . Cumulus Corp. is shipping an upgraded software package to customers of its **CuRAM** PS/2 multifunction boards. The free upgrade adds EMS 4.0 support and a new menu-driven user interface. Cumulus, Cleveland, Ohio; (216) 247-2236.

OS/2 CONVERSIONS

SuperProject Expert/2

SuperProject Expert/2, an OS/2 version of the *SuperProject Expert* project management software, runs under protected mode, adds multitasking capabilities, and can access virtual memory up to 16MB. *SuperProject Expert/2* retails for $795, and upgrades are available to registered users of *SuperProject Expert* for $100. Registered users of *SuperProject Plus*, Version 3.0, can upgrade for $195. Computer Associates, San Jose, Calif.; (408) 432-1727.

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LQ 1050 260 CPS, 88 NLQ	659
LQ 2500 324 CPS, 108 NLQ	849
EX 800 300 CPS, 60 NLQ	399
EX 1000 300 CPS, 60 NLQ	469

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192 Plus 200 CPS	305
193 Plus 200 CPS	439
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293 Plus 240 CPS, 100 NLQ	575
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Laser Line 6	1450

TOSHIBA

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351 SX 350 CPS, 100 NLQ	950
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P5XL/P9XL	850/1030
3550/8850	725/1020

PANASONIC

1080I Model II	185
1091 Model II	199
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1592	405
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20 + 20 w/card	1925
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20 mb external w/card	1195
dual 20 mb external w/card	1795
SYSGEN Durapack single	925
dual external/internal	1695/1395
Plus Hard Card 40	709
Plus Hard Card 20	525
Priam 60 mb AT	819
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MODEMS

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Hayes 1200/2400	279/419
Migent Pocket Modem	125
US Robotics 2400 direct internal	169
Ventel Half Card 1200 w/Crosstalk	259
Vental Half Card 2400 w/Crosstalk	359
Ventel 1200 Plus	239
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Ultrasync	499

IBM

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Color Display 8513	515
Color 8514	1150
Magnavox RGB80	259

NEC

NEC Multisync 11	589
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NEC Multisync GS	199
NEC Multisync XL 19"	2075

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Microsoft Excel	329
Microsoft Works	129
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Peachtree II Complete	149
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802-87-8.....**249**
80287-10.....**299**
8087-3.....**119**
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10 mhz, 1 mb Ram, 1.2 floppy.....**$1095**
Club 386 16 mhz, 1 mb Ram, 1.2 floppy.....**$1850**

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12 mhz - 0 wait state, 1.2 floppy, m.b. Ram, serial/parallel port, clock calendar, DOS.....**$1895**

Wyse 386 system, 1.2 floppy, 1 m.b. Ram, serial/parallel port, clock calendar, DOS.....**$2595**

All Wyse Systems carry a 1 year manufacturers warranty — parts and labor.

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Toshiba T1100 Plus....**1450**
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T3200.....**3895**
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HERCULES GRAPHICS **181**
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ORCHID EGA.....**259**
PARADISE Auto Switch 480 .....**159**
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QUADRAM EGA PLUS **169**
QUAD PRO SYNC.....**209**
SIGMA COLOR 400 .....**299**
NEC GB-1 Multisync **199**
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EVEREX MAGIC CARD II w/384K.....**175**
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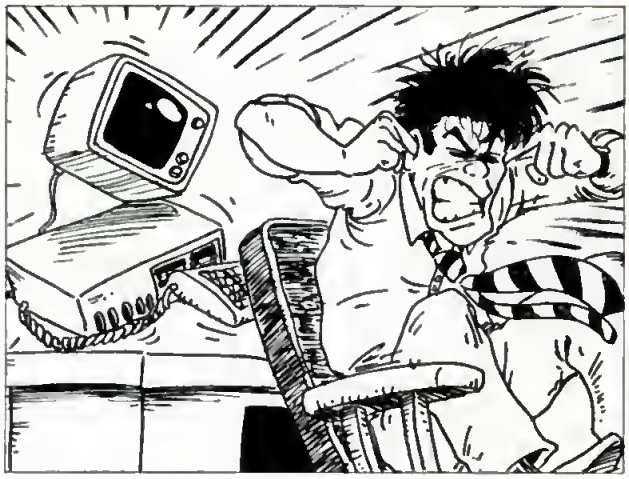
CIRCLE 481 ON READER SERVICE CARD

COMMUNIQUÉS

edited by Bill Howard

But Was It a Big Bang from an 80386 Or the Softer Report of a 4.77-MHz PC?



"TUSKEGEE—Lula Bridges' first indication her co-worker at Tuskegee University had been shot was the sound of a body hitting the floor.

"She initially thought the shots she heard came from a 'computer backfire.'

" 'I really thought it was a computer backfire. I didn't realize it was a gun. Nobody else did either. Nobody saw or heard anything,' Bridges said."

—The Montgomery *(Ala.)* Advertiser, *January 27, 1988*

Same model, same selling price, same features; take your pick of designs and original list prices at Houston's Computer Post stores.

Illustration Delfin Barral

Heloise's Hints

"When running Advanced Netware 286 with a non-dedicated server on Arcnet hardware, an ITT XTRA PC won't function as a workstation . . . Try disconnecting the batteries to the DMA channels and clock channels run off the clock on the file server."

—LAN Magazine, *January 1988*

You Can Call Me Ray

"[IBM] recently entered into a joint development and marketing agreement with Supercomputer Systems, Inc. SSI is a newly formed company headed by ex-ray research scientist Steven Chen."

—Tucson *(Ariz.)* Business Journal, *February 22, 1988*

Classified Intelligence

Computer Reporting Analyst . . . Experience with Framework, D-Base 3 recreational databases, and/or fourth generation languages is preferred.

—Microtel, Inc., Boca Raton, Fla., Telephone International, February 1988

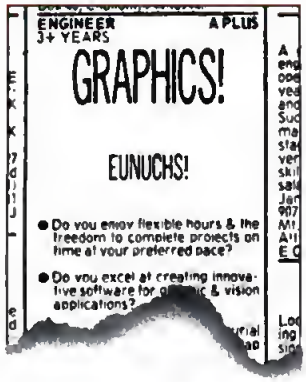
Apple IIE Enhanced 2 disk drives, color monitor, Image Raider II, printer, 1200 baud modem, joy stick, over $2,000 in software w/ disk holder. 1 yr. old. $2,000 or best offer. xxx-xxxx

—Houston Post, *February 18, 1988*

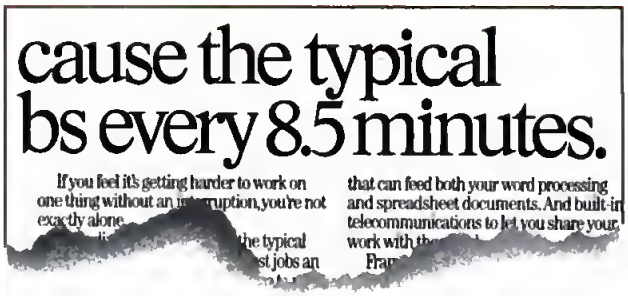
What About Skisoft?

"Innovations in fabric have improved the warmth of the sleek styles many skiers, especially women, want on and off the slopes. These new fabrics—marketed by such names as Microft, Tactel, Microsoft, Supplex, Thermolite and the Gore Tex Z-liner—have given way to silhouettes so soft that skiwear is beginning to resemble sportswear and even exercise attire."

—The Morning Call *(Coopersburg, Pa.), February 14, 1988*



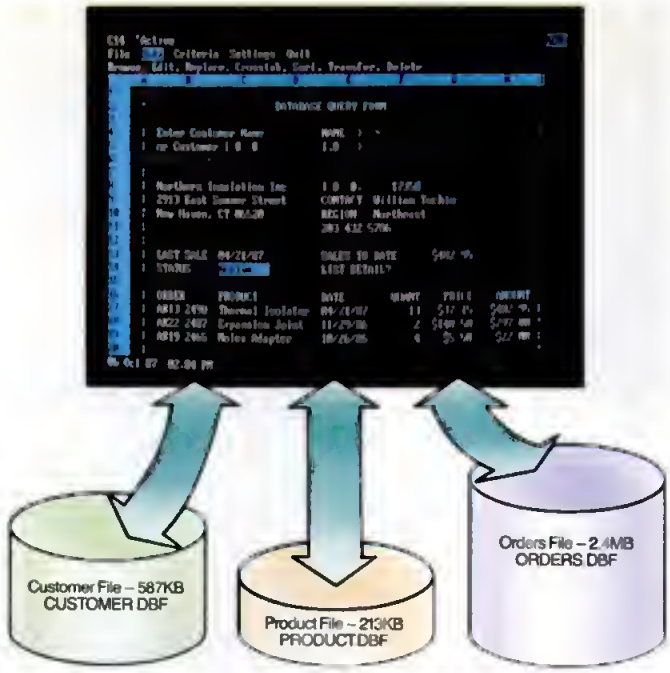
Most engineers we know are averqualified. (From The Philadelphia Inquirer, *February 14, 1988.)*



A two-page ad for Framework II *still works well if you fold it in half and just look at the right-hand page, pictured above. The two-page version says "Framework II. Because the typical manager changes jobs every 8.5 minutes."*

Have you heard or seen anything that is offbeat, unusual, or just plain dumb about the computer industry? Send your offerings to Communiqués, PC Magazine, *One Park Avenue, New York, NY 10016 or MCI Mail 157-9301. Please print your name legibly; include the name, city, and publication date of any newspaper or magazine clipping that you submit; and include your T-shirt size. Contributors receive $50 and a* PC Magazine *T-shirt.*

Winners this issue: Foster Schucker (eunuchs), Tom Vis (Framework bs), Charlie Randall (Panasonic printers), Tommy Patterson (computer backfire), David Reinhart (recreational databases), Keith Rice (Image Raider), Dave Anderson (ex-ray research), Mike Masko (Microsoft skiwear), Jeff Slama (DMA batteries).



dBASE Power for 1-2-3

Last year we met a crazy programmer who said he could build a database with the power and capacity of dBASE and put it *inside 1-2-3*. Well, he works for us now, and if you know anything about database programs, his baby is going to knock your socks off.

Introducing @BASE, a full-feature relational database add-in for 1-2-3. Now anyone who knows how to use 1-2-3 is an instant database wizard because @BASE turns 1-2-3 into a powerful "front-end" for database applications. *It's as easy as 1-2-3.*

Huge capacity

If you've every tried to use 1-2-3 as a database manager, there's a good chance you've run out of memory. That's because 1-2-3 stores data in the worksheet. @BASE stores data on disk where record capacity is virtually unlimited. You'll never run out of memory again.

Brains and brawn

@BASE compares with powerful stand-alone database programs like dBASE or R:BASE,® but it operates in concert with 1-2-3. You get the best of both worlds. 1-2-3 gives you tools for data analysis. @BASE gives you big data capacity. Brains and brawn. It's a nice combination.

In minutes you can build a worksheet with dynamic links to the database on disk. (The worksheet might present a sales recap by region.) Next month, for up-to-date results, simply load and recalc the worksheet. Fresh database information is automatically linked from disk.

Industry-standard file format

@BASE uses exactly the same file format as dBASE III and dBASE III Plus. *dBASE is not required to use @BASE.* But if you have standardized on dBASE, @BASE fits right in. @BASE reads and writes dBASE files directly. No conversion is necessary.

At less than a third the cost of dBASE, you may decide to use @BASE instead of dBASE throughout your organization wherever users need easy access to dBASE information.

Serious Performance

@BASE beats dBASE III Plus in benchmark tests.* @BASE is up to 3.7 times faster!

	dBASE III Plus	@BASE
Locate record	12 sec	12 sec
Pack database	7.1 min	1.9 min
Sort database	10.8 min	4.5 min

*Test with 4,000 records, 34 fields per record

@BASE works with 1-2-3 Release 2 on the IBM PC, XT, AT, PS/2 and compatibles. Only $195. No competing add-in database can match @BASE for power, compatibility and performance. *Nothing even comes close.*

See our ad on page 160

CIRCLE 282 ON READER SERVICE CARD

Introducing @BASE
(pronounced "at base")

@BASE™ puts the power of dBASE III Plus® inside 1-2-3.®

With @BASE you can:

- Instantly transform an on-sheet database to a dBASE-compatible database on disk.
- Use 1-2-3 as a "front-end" for existing dBASE applications.
- Build a complete database application from scratch using 1-2-3 to control database functions.

@BASE Features

- Huge capacity – data is stored on disk.
- Occupies only 72K RAM + 8K per open file.
- Fully compatible with dBASE III file format.
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  - Form view
  - Crosstab view
- Powerful Query/Selection commands.
- Bi-directional data transfer between worksheet and database.
- Dynamic link between worksheet and database using new database @ functions.
- Fully compatible with 1-2-3 macros.
- Multi-level sort (ascending/descending).
- Global multi-field search and replace.
- Create/modify database definition.
- And much much more!

You can open, access and update multiple data files concurrently using special @db functions. An optional module, available soon, lets you "join" data files on one or more common fields, and support index files. Option price is $89.95.

@BASE™

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dBASE® Users—Attack the Mac with FoxBASE+/Mac

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FoxBASE+/Mac gives you speed to burn—plus the power and performance you've come to expect from Fox. In fact, FoxBASE+/Mac is *by far* the fastest database system available on the Mac today—up to *200 times* faster!

View Window.

The View Window is the master control panel for FoxBASE+/Mac's graphical, non-programming interface. Use it to open and close files, set up indexes, establish relations, access BROWSE, and even to modify database structures!

BROWSE.

FoxBASE+/Mac's BROWSE feature brings new convenience and power to database display and editing! You're in complete control—BROWSE lets you dynamically adjust the size and order of fields displayed, add or delete records, and split the window to show different database sections side-by-side. Together, BROWSE and View Windows *eliminate* the need to write programs for common database operations!

Integrated Graphics.

Copy and paste graphs, charts, diagrams and even pictures into your database—instantly! FoxBASE+/Mac gives you the power to display these graphics, or merge them into reports and documents!

You can create stunning screens like this with FoxBASE+/Mac—*immediately!* This actual FoxBASE+/Mac screen photo illustrates the View Window, Command Window, Integrated Graphics, Memo field editing, Trace and Debugging Facilities, and the BROWSE feature.

Command Window.

FoxBASE+/Mac's Command Window gives both experienced developers and novice user ultra-convenient access to the dBASE command language—just type a command into the Command Window, and it's executed!

Get The FoxBASE+/Mac Facts *Now!*

Call (419) 874-0162 for more information about FoxBASE+/Mac. Or visit your local software retailer.

FoxBASE+/Mac is part of the award-winning family of products from Fox Software. FoxBASE+ has been given the prestigious Editor's Choice award by *PC Magazine*, and scored an impressive 9.2 out of a possible 10 when tested by *InfoWorld*'s Review Board!

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CIRCLE 112 ON READER SERVICE CARD

■ BILL MACHRONE

TRINTEX: IBM, SEARS, TANDY. TANDY?

IBM and Sears have teamed up to build Trintex, a major assault on the Wiring of America. Is it a revolutionary videotex service or a colossal Trojan horse?

I've been trying to understand Trintex, the joint venture between IBM and Sears. Trintex will offer a service called Prodigy, intended to be the first successful videotex service in America. "Successful" means millions of users dialing up every day for favorite columns, sports information, weather maps, at-home buying services, and news.

The pundits have been predicting such services for years, and IBM is certainly no stranger to the concept. Stretch your memory back to the second round of product introductions for the PC*jr* and you'll find a complete set of accessories that made Junior into a videotex terminal. They were just a little premature—kind of like showing up for your wedding before you've proposed.

Today, 14 million PCs make a dandy installed base for videotex services. IBM, however, has never spent much time or effort selling software to its installed base. Is this time different?

Prodigy will go live in a few test cities in 1988, nationwide by 1990. It needs what Trintex calls a "high-function" PC, which translates to 256K and a CGA card. That's certainly higher-function than a Commodore 64, but there's got to be more to this than meets the eye.

Would IBM back a venture based on essentially obsolete technology? I don't think so. Join me in an exploration of some facts and fancies. See if you don't draw the same conclusions.

Fact: IBM and Sears teamed up a couple of years ago to back Trintex, the latest shot at videotex for America. CBS was an original partner, but dropped out over a year ago, in November 1986.

Fact: Prodigy has two major services: Residential and Commercial. The Residential service is based on a flat monthly fee of $15 for as much connect time as you want. The Commercial service, like existing on-line services, charges additional fees for specific databases and services.

Fact: You dial into Prodigy from your PC to a local number. Somewhere close to your central office is a hoary old IBM Series One minicomputer. It talks to mainframes that actually run the service you requested. Does the architecture sound vaguely familiar? It should. It's been around for years. You've seen it before as a reservation system. The 'frames are running IBM's AOS (Airline Operating System).

Fact: To succeed, Residential will have to sell well on a city-by-city basis. Otherwise, Trintex's flat $15-per-month rate doesn't pay for the Series One in the local telephone exchange.

Fact: Trintex is said to have 100 artists designing screens, reports, and layouts. The 40-column graphics screens the field people have been showing around, however, are reported to hover midway between boring and ugly.

Fact: IBM has invested millions of dollars in The Media Lab at MIT, a prime repository of American video technology and the most likely birthplace of the next communications revolution.

Fact: IBM is in the business of selling iron. The true purpose of software is to sell hardware.

Fact: Trintex has been shopping around hard for any and all databases it can lay its hands on. Commercial, educational, reference, anything.

Fact: Sears will sell Prodigy subscriptions.

Fact: ComputerLand will sell Prodigy subscriptions.

Strong rumor: Tandy will sell Prodigy subscriptions.

Strong rumor: Tandy will build PS/2 clones. Which ones? How about Model

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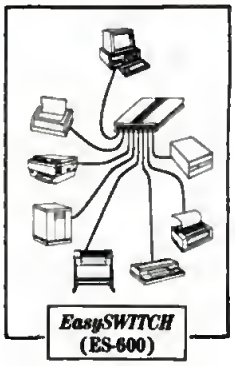

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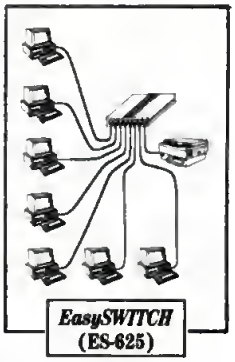

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25s and 30s? It's in keeping with Tandy's low-end orientation, and it certainly avoids the issue of whether anyone but IBM can build Micro Channel machines legally. Tandy is already committed to using 3½-inch drives and knows how to engineer an 8086 on an XT bus. The only significant piece left is MCGA graphics, which is no big deal.

■ IBM has invested millions of dollars in The Media Lab at MIT, the likely birthplace of the next communications revolution.

Hypothesis: The awful stuff the field guys have been showing is only the tip of the iceberg. The artists have been working on beautiful images for MCGA graphics. The synergy of PS/2 graphics and Prodigy screens will be a real winner. Thus, Trintex is a way to sell low-end PS/2s into the home.

Hypothesis: The artists have also begun work on knockout 8514 images. Thus, Trintex will be a way to sell high-resolution (beyond VGA) graphics to the workplace. It also becomes another incentive to use the Presentation Manager and OS/2.

Thought: If IBM has a Master Plan, all this makes sense. The software, catalogs, and databases will drive low-end hardware sales, largely hinging on beautiful 320 by 200, 256-color images. The Model 25, whether you buy it from IBM or Tandy, could be the de facto Prodigy terminal. In exchange for increased volume and increased visibility on the low end, Tandy would probably be happy to let IBM have the Fortune 1000 and the video high end. If IBM has no Master Plan, and the 40-line CGA product is the real Trintex, stand out of the way. The thud will be deafening. PC

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FERRARI DOS: DON'T HOLD YOUR BREATH

Are you sick and tired of waiting for a slow system prompt and ready to do something about it? You can start by hanging out at the golf course.

I've harped on this over the years and I'll never stop harping on it. We need alternative operating systems that are MS-DOS compatible. I talk to developers about this all the time, and they always say there is no money in systems software. When I tell them that Bill Gates didn't become a billionaire with royalties from Altair BASIC, they shrug their shoulders and continue their design of another spreadsheet program.

People like alternatives. That is, alternatives that are useful. The only alternatives we've seen are either totally oddball or nothing more than another UNIX clone.

Vendors forget how users love alternatives. During the brief dominance of the TRS-80 computer in the late 1970s and early 1980s, there were no fewer than six available alternatives to TRS-DOS: Dos Plus, DOS 3.0, NewDos, NewDos/80, LDOS, and LiiCOS, not to mention two versions of CP/M. Most people owned at least two of these alternative operating systems. They sold for about $150 and made a lot of vendors filthy rich.

What's the problem today? Bad marketing and new personal values, that's what. Among recent efforts, Wendin-DOS—written by the Jones brothers of Washington—is one of the few MS-DOS clones we've seen. Who knows where to find it? The problem: bad marketing.

Meanwhile, the Jones brothers wanted to develop an operating system called Share-DOS but refused to do it on speculation, choosing instead to pitch it to would-be investors. Microsoft got wind of the product and hired away the Jones brothers, who will now work in relative comfort and obscurity at the black hole called Redmond, Washington. The problem: new personal values.

CORPORATE BORES Unfortunately, unlike the situation during the TRS-80 days, our new gang is influenced by the businessmen who use IBM machines. Many of these fellows are boring. The poor guy with the better idea, influenced by this boring atmosphere, develops a preoccupation not with *doing* but with writing business plans. This is worsened by the influence of venture capitalists (VCs) and further worsened by those incestuous and expensive conferences where people pay too much money to listen to the same 13 guys say the same 13 things about success.

The insight shared by this baker's dozen applies only to the speakers and—maybe—General Electric. For the small-timers it means bad luck. They are led to believe that their smallish company should be run like Compaq, so they spend all their time on analysis, business plans, and corporate financing, hoping desperately that a clannish venture capitalist will throw money at them like there is no tomorrow. The VC is usually playing golf or hanging out with other VCs in a world of their own—a world preoccupied with dollars and cents, dubious public offerings, and chitchat about Mercedes-Benz repair shops. This is not a world of products and ideas.

A small-timer with a great idea is not listened to, unless the small-timer happens to be the former CEO of at least one semiconductor firm and two bankrupt start-ups that went bankrupt only because of unfortunate market conditions (or so it says in the business plan). The ability to shoot a decent game of golf helps too.

Surely none of these bean-counters will ever appreciate history or the need for an alternative MS-DOS–compatible operating system designed for one thing only: speed.

Ferrari DOS. People can't get enough speed. Surely a huge clunker like OS/2 will never perform like a mean, lean single-tasking OS designed for throughput. Instead of Ferrari DOS, we get stagnation.

This stagnation is causing discouraged computer enthusiasts to find other interests. The kingpins in all this, once enthusiasts themselves, can now go off and play a game of golf with their VC friends. Meanwhile, we, the everyday users, sit and wait an eternity for the system prompt on our boring computers.

It's going to be a long wait.

Illustration: Warren Gebert

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■ JOHN C. DVORAK

INSIDE TRACK

Is CD-ROM still waiting for Godot? Have we found OS/2's secret value? What's the worst computer book yet?

I recently returned from the **3rd International CD-ROM Conference** sponsored by Microsoft—disappointed. Not so much because there wasn't anything going on, but because there was a lot going on and none of it involved the enthusiast. Listen carefully.

The big roadblock holding up the mass appeal of the CD-ROM is **the price of the drives.** The same 50-buck mechanism that goes into the $179 compact audio disk player goes into the $1,000 CD-ROM player. From the audio player, take out the expensive digital filters, fancy displays, infrared remote control, extra push buttons, and other fancy footwork, then add a cheap controller card and a cable to get a CD-ROM player. This exchange, for some unknown reason, costs $800 or more. **Pretty expensive cable,** I'd say.

My disappointment in all this is that there are no **wacky** little companies that have taken, say, a cheap second-generation Technics drive (as used in a compact disk unit) and produced a kit allowing its use as a CD-ROM player. Where are the hobbyists when we need them?

At the conference, nearly everyone who makes compact disk players was there with OEM drives for the Amdeks of the world. Denon, Sanyo, Panasonic, Hitachi, Toshiba, JVC, and others showed their **expensive CD-ROM drives** that any good old American company could buy and put its name on. Note that no homegrown CD-ROM drive makers exist. No competition from Americans means **gouging** by the Japanese (just as the alarmists always warned us). The fact that the "price learning curve" (which results in drastically lower prices over time) has not appeared indicates **a sinister plot—price fixing.** There's absolutely nothing we can do about it since our government doesn't control overseas manufacturing. Meanwhile, the CD-ROM scene stagnates. Let's hope that Samsung or Goldstar or some other Korean electronics firm can bail us out of this mess. Obviously our own hobbyist community just isn't interested and our General Electrics, IBMs, and Westinghouses **haven't the technical wherewithal.** Things just get worse, don't they?

Genuinely Interesting Software, Part 1.: Do you want to see the **absolute fastest** video drivers ever written for the PC? For $30 buy a copy of *Acrospin* from Acrobits, 925 Oak Lane #4, Menlo Park, CA 94025; (415) 328-0542. Included are various 3-D models and Pascal programs allowing you to design wireframe figures that you can spin and move in real time on CGA or EGA **like nothing you've ever seen.** At first I was surprised by the speed of movement until I discovered a command that turned off the slowdown mode I was in! Hot stuff. Vendors of other real-time software should call these guys and license the algorithms.

Oh-Ess-Too! Applications Dept.: While nobody else knows what the heck OS/2 is good for, I do. I saw the OS/2 version of *PC Paintbrush*—one heck of a program. Someone had scanned a high-resolution shot of a **ten-dollar bill** (660K file) and was editing it in full gray scale. Let me just say this: the U.S. Treasury had better get back on the stick and develop those pink and blue dollars that can't be copied.

While on the subject of OS/2. Do you ever wonder if there is a "worst computer book"? (The scary thought is that someone is reading it right now!) One that comes close to being the worst is the giant 756-page tome from McGraw-Hill called *Using OS/2* by Kris Jamsa. Obviously, this is a repackaged version of Jamsa's previous book, *DOS: The Complete Reference*. A few words were changed to **dupe the unsuspecting buyer.** For example, in the book it clearly says that OS/2 will not run on a PC or XT. Yet all the illustrations are of PCs and XTs. Even a one-disk-drive system is used as an exemplary machine. There is more than a hint that you can run OS/2 on a single-disk system—although a "10-megabyte" hard disk drive (where can I find one of those nowadays!) is recommended. To illustrate a modem the book shows an old clunker into which you have to shove a phone handset. **It's pathetic.**

I suppose the editors are to blame for some of this stuff. A friend of mine used to brag about how great they were at McGraw-Hill because "they really checked everything." Right. A sentence in this book is **typical** of editorial diligence. On page 96 it says: "It is against the law to distribute copy-protected software." Yipes! Better tell Lotus!

Enough said. If you want a book about OS/2, you'd better avoid this one and get **the one from Microsoft.** Microsoft Press didn't rush its book out the door just to be first.

Genuinely Interesting Software, Part 2.: I love utilities like this. Dubbed *VP/BASE*, this is a package that takes *dBASE* files and converts them into a format to be printed by *Ventura Publisher* in such a way that the database is turned into a directory. **Directory publishing** at its easiest, no kidding. The company's other really hot product, *VP/TABS*, turns an ordinary Lotus worksheet into beautiful typeset-looking output via *Ventura*. Hot stuff. These nifty little packages are $89 each. Write The Laser Edge, 360 17th St. #203, Oakland, CA 94612; (415) 835-1581. PC

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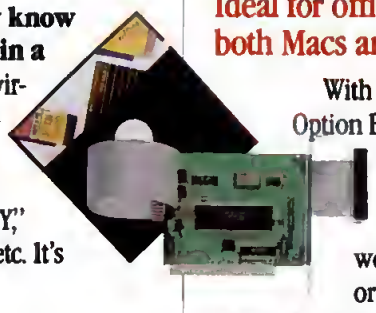

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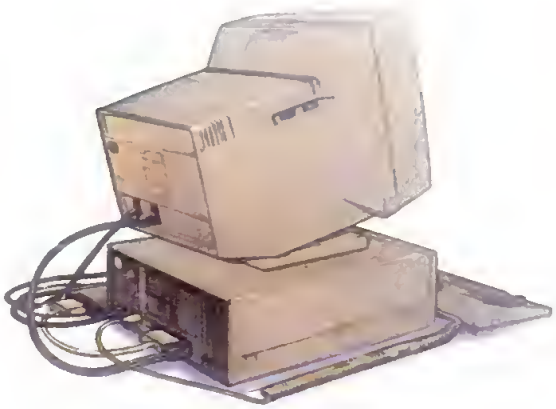

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CIRCLE 278 ON READER SERVICE CARD

■ JIM SEYMOUR

RAM SCAM '88

Though memory prices are high, adding more RAM (and lots of it) to your system is still the best way to improve its performance and to get the most out of OS/2.

This isn't Kansas anymore, Toto. And the yellow brick road lying ahead of us in the Land of OZ/2—oops, OS/2—and OZ/3 and beyond is in large part paved with RAM.

More memory isn't the answer to all our woes, but it comes close. From faster program execution to true concurrent operations to higher-resolution displays at least 8 bits deep in color to managing larger data sets with reasonable speed, RAM chips hold many of the answers.

TO TELL THE TRUTH Which leads me to wonder when we're going to start telling ourselves the truth about how much RAM we're going to need in this new era.

PCs being sold for use with OS/2 typically come with 1 megabyte of RAM installed. That's hopeless, and it doesn't reflect well on vendors' grasp of reality.

To its credit, Zenith recently upped the amount of RAM installed in its Z-386—a fine OS/2 platform—from 1 to 2 megs. Cynics will observe that Zenith also just shipped its house-brand OS/2, which won't run in 1 megabyte of RAM. Realists, examining the same facts, will commend Zenith for playing fair with its customers.

But in truth, 2 megs don't come close, either.

If you're serious about OS/2, you start with 3 megs. In fact, I'd guess that 2 megabytes of RAM is going to become the new 256K.

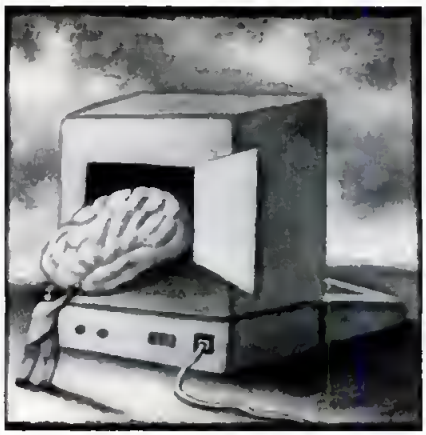
Let me explain.

Remember when *1-2-3* for PCs appeared in 1983? And took an outrageous 256K of RAM—in an era when a lot of us had just upgraded to 128K by installing one "row," or 64K of RAM, on a 256K-capacity Quadboard or AST SixPak?

It said right there on the Lotus box that *1-2-3* required a minimum of 197K. Since memory had to be increased in 64K units, we swallowed hard and installed another 128K of RAM—two more rows of 64K-bit chips—in that expansion board, zipped up the box, and went to work.

And discovered that while, yes, you could actually load DOS and *1-2-3* into 256K, there wasn't a whole lot of space left over for . . . spreadsheets. In other words, while it was perfectly true that you could get by with 256K, you were left with a pretty blunt tool, one that we soon realized fell far short of the true capability of this new wonder.

Even when we filled the rest of the 256K memory-expansion board, we still didn't give *1-2-3* the room it really needed. IBM finally came along with motherboards that accommodated 256K; the memory-board vendors replaced their 256K boards with new versions that accepted up to 384K; and serious *1-2-3* users got the 640K of RAM we'd needed all along.



(It wasn't much longer, of course, before we started hearing screams about "hitting the 640K barrier," and Microsoft, Intel, and Lotus hatched the LIM expanded memory spec to allow paged access to lots more memory.)

Plus ça change . . .

Using OS/2 with 2 megs feels a lot like those old days when we used *1-2-3* in 256K. We can do useful work, but we're forsaking much of the power of the tool. Sadly, like those *1-2-3* users who resolutely stayed at 256K of RAM for as long as possible, lots of OS/2 users will stick with 2MB as long as they can. Because that's all you're *supposed* to need.

But multitasking operating systems exist because people want to multitask. Ergo, we need enough RAM to *allow* multitasking. Which means, at absolute minimum, 3MB—and realistically, about 5MB.

That also means you should be careful as you shop for add-in memory-expansion boards for PC ATs and PS/2s that you intend to use as OS/2 platforms. Buying a 2-meg memory board is going to give you only temporary relief: either that board accepts a plug-in daughterboard with another couple of megs of RAM, or you're going to have to give up a second slot to get up to the 5 megs I think serious OS/2 users will consider a practical minimum.

It also means looking for large internal

Illustration: Warren Gebert

■ JIM SEYMOUR

RAM capacity in new PCs bought as future OS/2 and OS/3 platforms. Some of the new machines hold vastly more memory on their motherboards, or on a single internal memory card, than older PCs. AST's Premium/386, for example, accepts up to 13MB on its single-slot memory card. That's not just dollars-and-sense economy; it's slot economy, too—saving expansion slots for future needs.

I put my money where my mouth is: the 286 PC I use with OS/2 has 5 megs; the 386 PC I use now with DOS and *Windows/386*, and will someday use with OS/2, has 4 megs; my Mac II has 8 megs; and so on.

THE HIGH COST OF RAM I recognize that these are expensive times to buy RAM, with memory prices increasing by as much as 200 percent. Between the signing of a 1986 trade treaty with Japan and this spring, the 256K-bit DRAMs most widely used in PCs have tripled in cost, to more than $6 each. (Swell treaty, huh? Isn't protectionism a great way to enhance trade?) One-megabit DRAMs, whose prices should by now have moved well down the price/experience curve, have actually been going back up lately, toward the $40 point.

■ We ought to dispel the myth that 2 or 3 megs of RAM is anything like a really useful allocation of memory for OS/2.

Even Mother Nature seems to be conspiring against cheaper RAM: an earthquake in December of last year took a major Japanese 1-megabit DRAM factory out of production.

Despite the higher prices, RAM is still a bargain. Almost nothing you can add to a PC will do so much to improve its performance as adding more RAM; and now that we have operating systems and DOS-extenders and memory managers designed to let us use gobs of RAM for more-sophisticated ends than big disk caches and RAM-disks, we ought to take advantage of the economies of adding RAM.

And we ought to dispel the myth that 2 or 3 megs of RAM is anything like a really useful, let alone optimal, allocation of memory for OS/2.

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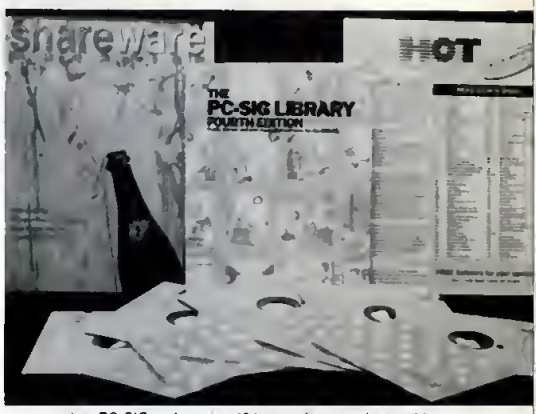

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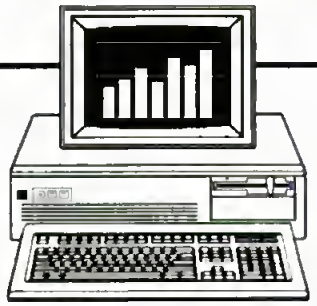

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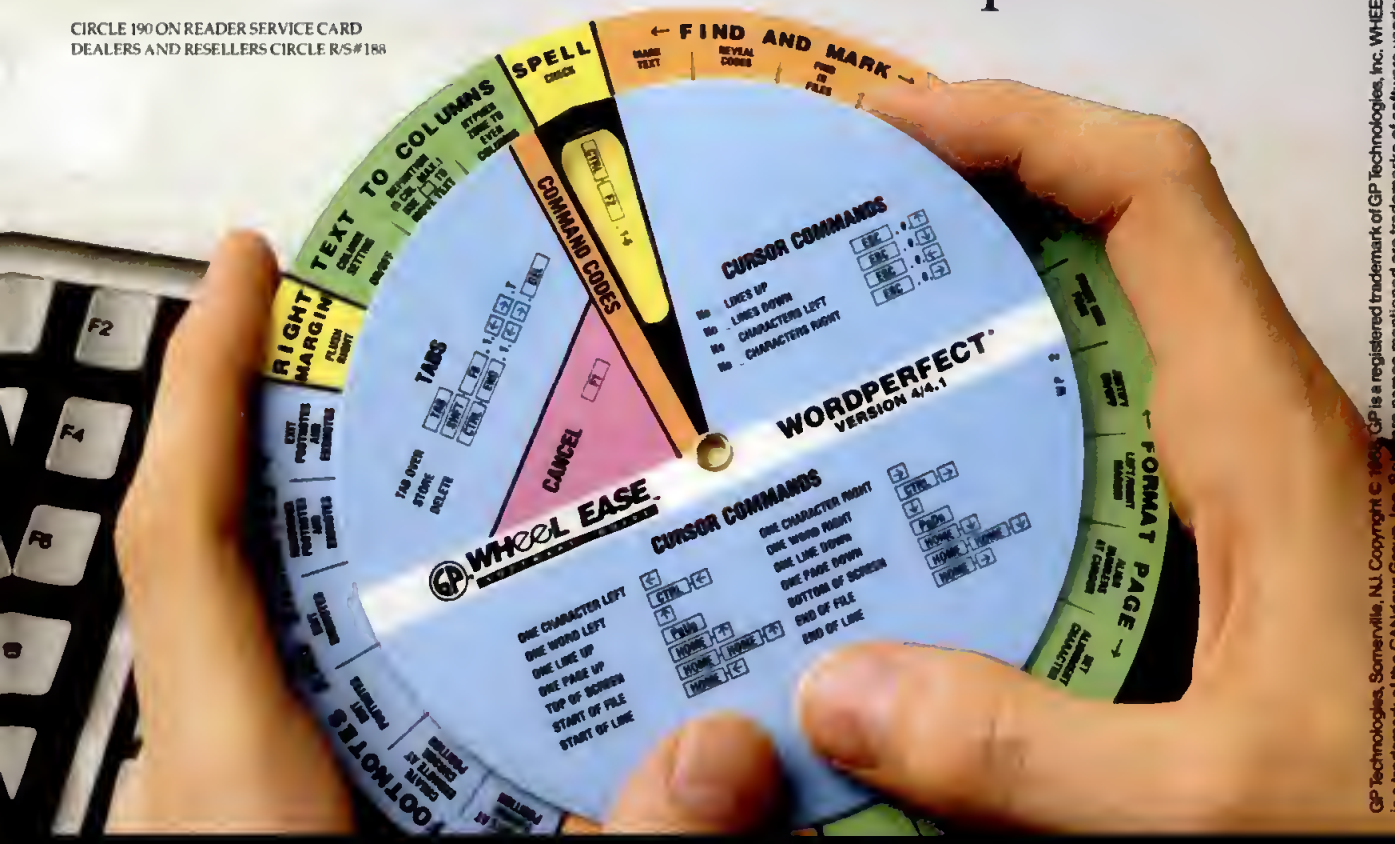

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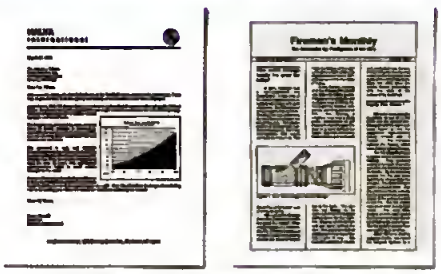

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And WordPerfect 5.0 lets

mances can be ing WordPerfect 5.0.

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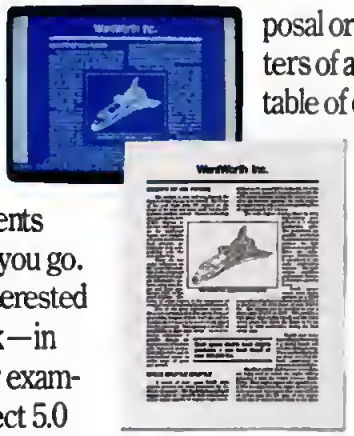

WordPerfect 5.0's improved Preview feature lets you see what your document will look like before you print.

And WordPerfect 5.0 offers many other sophisticated advances. Like an improved Preview that shows you what your document will look like before you print; letting you see actual font sizes, proportional spacing and justification. It also lets you zoom in on details, display an entire page of text and graphics at once, or view facing pages together.

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■ STEPHEN MANES

READER MAIL: VEILED THREATS, TALKING DOGS

How do you get better treatment from vendors than even columnists do? Move to high-tech Crystal Lake, Illinois, or computer-literate Booth, West Virginia.

Either this column's circulation is picking up or both of my readers have been busy running around the country acquiring fake postmarks and stolen passwords to send me clever forgeries via MCI and U.S. Mail. My piece ("Type 'Type': How's That Again?", *PC Magazine*, January 26, 1988) about setup snafus and stupid salesfolk somehow unleashed a cascade of correspondence.

First the meager good news: two lucky correspondents are actually happy with their dealers. A store called Computer Bay in Crystal Lake, Illinois, did right by Edward Nachel of Woodstock, same state. He says the shop gave him good prices and accurate information—not to mention a properly set up hard disk complete with CONFIG.SYS file.

And Terry Griffin of Booth, West Virginia, reports the local Radio Shack dealer "was always available by phone or in person to answer my questions on using software or the computer even when none of the software was purchased from him." Griffin concludes: "Seems like a company that makes talking dogs can sell a lot of computer equipment just by being nice."

CRACKLING WITH CYNICISM Maybe we should send some PC Labs analytical equipment to investigate those atypical experiences; the rest of my mailbox is aflame with indignation, cynicism, and contempt. Consultant William J. Bean of Boulder, Colorado, writes, "I don't sell the system . . . but guess who gets to 'fix' the mess when it hits the fan." He warns: "Beware the computer stores. You might as well be walking into a car dealership. Fact is the sales staff probably know as much about computers as they do about quantum physics or thermodynamics."

Headquarters personnel, apparently, don't always know a whole lot more. A reader who spent 2 years as a tech support rep in an IBM Product Center reports that "a favorite problem was trying to install IBM Displaywriter printers on PCs and XTs. No one in heaven or on earth could get those suckers to work continuously until we managed to glean a line of wisdom from someone in Atlanta about inserting the MODE:LPT1,,P command into our batch files. And that only took about 2 months to find out."

Do big corporations get better service than little guys? Not according to two Fortune 500 correspondents. The first, a PC expert from one large insurance company, supports application programmers who "know VS COBOL Workbench and some IBM Macro Assembler and that's it. Put them at the DOS prompt and you might as well send them on a one-way trip to the Enchanted Forest." The vendor supplying his machines set them up with neither AUTOEXEC.BAT nor CONFIG.SYS nor any DOS files other than COMMAND.COM. Only "corporate pressure" and "veiled threats" finally got the vendor to put DOS on the machines.

A self-described "PC guru" from another Fortune 500 company fared about as well after flying 600 miles to Texas to diagnose a recurrent "network problem." In 5 minutes he learned it had nothing to do with the network; the trouble was the tiny power supply in the senior sales manager's secretary's old-model machine. It died whenever she tried to send her boss's mail; she, of course, cursed the network.

After several frustrating phone calls, the guru ended up having to lambaste the corporate headquarters of the unnamed (I have my guess) vendor, walk down to the local store, rework the company's credit limits, and install the power supply. Everything worked fine—until the senior sales manager, supremely annoyed by the episode, "had the entire network yanked out and shipped to a different office." Upshot? "We no longer do business with that vendor in the state of Texas."

CRT OR CPU? A long, weary letter from Pam Coles of Chicago details the all-too-familiar problems of novices. "With the little training many operators receive," she writes, "it's no wonder some suspect their PCs are alien objects dropped onto

Illustration: Warren Gebert

■ STEPHEN MANES

their desktops—and consider it a distinct possibility that someone or something might just be in there staring out at them!

"During a break in a seminar," she continues, "I heard several ladies discussing their office computers. One said, 'I don't know what to do with it. I just push this button and type and then push something else and that's my job.' Another commented, 'I just found out how to turn mine on.' I was amazed. These ladies had been using their computers to do their jobs, some for weeks. Curious, I joined the group and asked the one who had just learned how to turn hers on, 'What kind of computer do you have?' 'Oh,' she replied, 'mine is a CRT. But hers is a CPU.' "

In my column I griped about vendors who put needless DATE and TIME commands in the AUTOEXEC.BAT files of machines that come with real-time clocks. Two consultants I shall call Dimbulb and Crony actually defend this practice as "important for verifying the accuracy of the clock" and useful "in accounting firms to change the system date for a client's after-the-fact accounting of other date-sensitive programs." I suspect they may have devised this technique to help fudge their own billing logs.

A different breed of consultant, Mark E. Cohen of Comish, New Hampshire, describes a dealer who insisted on including the line "COMMAND" in all the AUTOEXEC.BAT files of IBM PS/2s he sold—ostensibly to show the customer the IBM copyright and version number of the operating system. However, Cohen reports bemusedly, the dealer "never could figure out why anything he entered after that line was never executed."

Then Cohen gets uppity. "In your article," he notices, "you tell your client to change subdirectories by typing '\WP'. Did you mean to say 'CD \WP' or am I missing something? '\WP' doesn't do anything on my system (PC-DOS 3.30) except 'Bad command or filename.'"

Uh . . . well . . . I've got excuses, okay? My CD matured a few months ago. My apartment was robbed, and they stole all my CDs. I use only advance versions of DOS; with my DOS 6.7, the \WP command works precisely as I described. Besides . . . oh, all right. I take back those nasty remarks about consultants.

Some of them, anyway. Carol J. Blugerman of Georgetown, Colorado, writes, "Your comments on DOS were right on. Even with the manual, a book, an 8-hour class, and lots of help from my tutor, I'm still not comfortable with it. What's going to happen when the modem arrives? Will I have to hire a consultant?"

Ms. Blugerman, meet Dimbulb and Crony.

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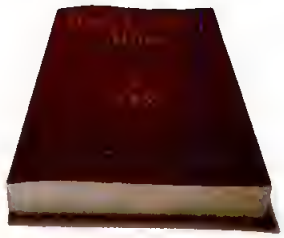

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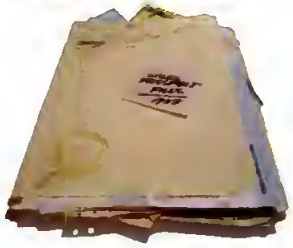

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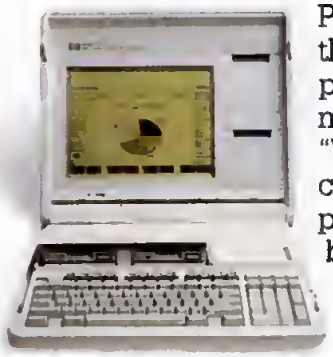

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COVER STORY

JIM SEYMOUR

Hard disk failure: it's a catastrophe waiting to happen. Hard disk backup: it's the obvious safeguard against data loss. Don't let human nature and natural disaster send your work into the abyss. Backup products are less tedious and time-consuming than ever.

BACKING UP. IT'S A MESSY JOB, but somebody's got to do it.

Or rather, somebody *ought* to be doing it. By every survey and poll, most PC users still refuse to acknowledge the need to regularly back up the hard disks in their computers.

That, despite the clear and present danger of the data on those hard disks being lost—whether from an electro-mechanical failure of the disk itself, or from damage to the computer from an environmental disaster such as fire or storm damage, or from theft of the whole computer by the friendly neighborhood junkie.

No matter how common hard disk failures are (and we all know someone, maybe several someones, whose disks have gone south due to a head crash), nor how often we're urged to make backups, human nature intervenes and we put it off for another day. So that when the almost-inevitable disk crash *does* come, we're left remembering that we really meant to get around to doing a current backup . . . but never did.

Computer manufacturers haven't done much to improve our lot. Alone among major PC vendors, Compaq has, from the beginning of its Deskpro line, offered built-in mass-storage backup as a standard (read: relatively common) option. While virtually any PC can be fitted with an internal backup device of some sort, building one in at the factory—or at least, sticking it into the PC in the dealer's back room before delivery—reinforces the idea that backing up your hard disk ought to be a regular part of your routine.

Vendors would argue that every PC they've ever delivered has a perfectly usable backup system installed: a floppy disk drive. With DOS's BACKUP and RESTORE commands, a tall stack of floppy disks, and an afternoon to while away, you can do a perfectly acceptable job of making a protection copy of the contents of your hard disk.

And while few of those who've used other software for floppy disk backup—and especially those who've used other media, such as tape or Bernoulli cartridges—would argue that it's the best way

to go, a significant percentage of those who do attend to making backups do so with DOS.

Actually, while tape and other media are a lot more convenient, the increasing capacity of the floppy disk units installed as the A: drive in our PCs has made backing up to floppies a lot more practical. The 5¼-inch 1.2MB floppy disk drives found on virtually all PC ATs and AT clones hold almost four times as much data as the 360K 5¼-inch disks most users consider the standard.

If you've filled up 30MB of that 40MB hard disk in your PC AT or clone, it will take you a daunting 87 360K floppies to back up that disk. And if you're following the good practice of rotating among three chronological sets of backup disks (see the sidebar "The Generational Backup System"), buying and managing more than 250 floppy disks just for backup becomes quite a burden.

But if you've used high-capacity 1.2MB 5¼-inch floppies, you'll need just 25 disks for the job, 75 for the three sets—definitely a much more manageable load.

The numbers hold true for 3½-inch microfloppies, too. If you're the proud owner of an IBM PS/2 Model 80, you can back up the same 30MB of disk files onto just 21 of the 1.44MB floppies used in your computer.

There are downsides to these calculations as well. As these hard disks get bigger, the number of floppies that are required for backup grows too, soon surpassing the limits of human patience. And as a hard disk of *any* size gets fuller, the number of floppies required for backups grows apace.

Fill up a 60MB hard disk in your AT, and you'll need 50 of those 1.2MB floppies for backup. Fill up the 130MB hard disk in your Compaq Deskpro 386/20, and you'll need over a hundred 1.2s. (Or to push past painful into ludicrous, 360 360K floppies.)

You get the idea: no matter how good the software you choose for backups, the sheer volume of floppies involved in backing up and restoring large hard disks quickly gets out of hand. There has got to be a better way.

There is: tape cartridges.

EARLY STREAMERS The first widely available "streaming tape cartridge" backup units for IBM PCs and compatibles came from Tallgrass Technologies, in Kansas. These "streamers" recorded the contents of your hard disk (or, more commonly, the hard disk installed in the Tallgrass box next to the backup tape drive, since those were the days when hard disks were exotic, external add-ons for PCs, not something you found in factory-stock PCs) on ¼-inch tape cartridges, which looked like a cross between high-tech audio cassettes and eight-track tapes from the glove box in your '65 Mustang. The tape cartridge, and streaming-tape technology generally, had a good reputation in the minicomputer world, where it was sometimes also used for software distribution.

Early PC tape units had marginal reputations for reliability: after staring at that frightening DOS prompt "General failure to read drive C:" for a while, many owners who dutifully backed up onto tape found,

BACKING UP IN THE FUTURE

As appealing as tape cartridges and cassettes sound to those users still doing backup on floppies—or to those daunted by the job—there are even better answers on the way. The first, backing up hard disk contents to a so-called WORM drive, is available today. The second, writing backup files to a tiny tape cassette hardly larger than a thick credit card, is just around the corner.

WORM (write-once, read-mostly) technology is a form of optical-disk storage that offers the security of a relatively permanent, huge-capacity medium. Optical WORMs intended for use on personal computers commonly range from 200MB or so to as much as 800MB in capacity—per disk or disk-cartridge, depending on design.

An 800MB disk can hold 40 weeks' worth of weekly full-image backups of a nearly full 20MB hard disk. At about $100 for the disk, that comes to a little over $2 per backup—and that's economical mass storage. Since the interface card and CONFIG.SYS device-driver software available with most WORM subsystems make the drive appear to the PC as just another MS-DOS device, many of the software packages in these pages can be used to manage the process.

DATs, or digital audio tapes, are even more promising, and definitely far more economical.

DAT audio equipment, available in Japan, has been kept out of the United States so far by a concerted lobbying effort by U.S. record companies afraid that the digital precision and economy of DAT cassettes will knock their booming CD-audio business for a loop by encouraging piracy. But Sony, which holds the basic DAT patents, recently bought CBS Records, a leader in the U.S. recording industry's opposition to stateside sales of DAT equipment. That effectively removes the strongest anti-DAT voice from the playing field, so DAT may finally begin appearing on U.S. audio dealers' shelves soon.

But Sony, unwilling to wait for that audio-DAT beachhead, announced in late February a PC data-storage alliance with Hewlett-Packard, a deal that is beginning to look like a replay of the same team's success in establishing the 3½-inch microfloppy disk as a standard here. DAT cassettes a little larger than a credit card can easily hold over 1.2 gigabytes—1,200 megabytes. The price for that blank DAT? Under ten bucks.

You can see why the excitement has been building over DATs. Indeed, some vendors, perhaps including Apple cofounder Steve Jobs's new venture, NeXT, are reportedly looking at DAT devices for primary storage. Access times for DAT systems are incredibly slow, compared even with floppy disks, so sophisticated caching and other tricks would have to be used to make them acceptable for on-line primary storage.

But DATs are fine right now for backup. Look for a Sony-HP DAT-drive package late this year in the $1,000 to $1,500 range.—**Jim Seymour**

one awful day, that when they had their hard disk repaired or installed a new one, their backup tape became somehow unusable.

Today's tape drives are much better. (Though still far from perfect: at a recent industry conference, a large corporate customer harangued Compaq chairman Ben Rosen, complaining about his two Compaqs, in which both tape units had turned out unusable tapes and no fewer than three hard disks had died.)

Unfortunately, that increased reliability has sometimes come at the expense, in part, of a maddening array of competitive and naturally incompatible tape-format "standards." We now also have shirt-pocket-sized tape cartridges; moreover, the way cartridges are formatted and the amount of data they hold vary greatly. The QIC, or Quarter-Inch Cartridge, group of vendors has worked on developing standards, and the picture is becoming less chaotic.

Besides tape cartridges, some vendors now also sell units built to accept tape cassettes produced by Teac. While these cassettes superficially resemble standard audio cassettes, there are substantial mechanical differences, in the interest of greater reliability. These less-expensive drives and cassettes make tape backup available to some users who could not or would not otherwise buy a tape unit. Recent developments have pushed data-cassette storage capacity up to 60MB.

Some tape units, such as those sold by Irwin (and provided originally to Compaq for the company's Deskpros), lay down a servo track on the tape. The speed stability and location accuracy of these servo-controlled tapes make it possible to use smaller, less-expensive drives; hence Irwin, too, can deliver backup subsystems at lower prices than those charged for units which do not require the servo track. But that servo track means that tapes must first be "formatted," a chore which, though performed only once, before the first use of a tape, still adds a bit more time and nuisance to the backup process.

BERNOULLI BACKUP Floppy disks and tape cartridges and cassettes aren't the only generally available answers for backing up your hard disk. For years, Iomega's Bernoulli Boxes have been used for backup as well as for primary storage.

There are two particular advantages to using two-drive Bernoulli systems for both primary and secondary storage. First, backing up the contents of the 20MB cartridge in drive C: to an identical blank cartridge in drive D: is nearly automatic, and very fast: I back up my nearly full 20MB cartridges in just over 4 minutes. That makes it easy to do weekly, even daily backups without feeling put upon.

Floppy disks and tape cartridges and cassettes aren't the only available answers for backing up your hard disk. For years, Iomega's Bernoulli Boxes have been used for backup as well as for primary storage.

Second, the backup Bernoulli cartridges are immediately usable, in the event their primary counterparts are damaged, lost, or stolen. There's no time wasted running a RESTORE command, crossing your fingers, and hoping it will work. Since a backup Bernoulli cartridge is a mirror-image copy of the original, just stick that backup in your Iomega drive and go to work.

Even if you already own one or more PCs with built-in hard disks and thus have no need for two-drive Bernoulli subsystems for primary storage, they can still make sense for backup use only—especially in large offices with many PCs. In fact, using a single Bernoulli Box to back up many PCs' internal hard disk drives can offer a lot of security and can be far more economical than installing even the cheapest tape backup units in each of those machines.

You'll need a Bernoulli interface card installed in each PC, plus one Bernoulli Box, preferably on a rolling cart. At some predetermined interval, whoever draws the short straw rolls the cart around to each user's PC, plugs a cable from the Bernoulli drive into the connector on the backplane of the interface card, and executes a special Iomega copy command. The contents of that hard disk are dumped onto a cartridge reserved for that user.

Each user's backup cartridge (or, better still, cartridges; see the sidebar on grandfather/father/son backup cycles, "The Generational Backup System") can be stored in some secure place. At large defense contractors, it's not uncommon to see grocery carts full of Bernoulli cartridges rolled into vaults every night—to protect the secret data stored on those cartridges.

Even with the labor costs involved in this kind of centrally directed backup, it's still an excellent, cost-effective way to make sure employees' hard disks are backed up regularly—without endlessly nagging employees to make backups, and without that nagging feeling that those backups just aren't being made.

Note that this approach is by no means limited to Bernoulli Boxes: it works fine with any external backup device for which extra interface cards are readily available.

In fact, large-capacity tape-drive units make more sense for shared use than do Bernoullis when the internal hard disks to be backed up are larger than 20MB, the largest-capacity Bernoullis available. Spreading a single disk's directories (and perhaps volumes) over more than one backup unit, in any medium, is a nuisance; that's unnecessary with the large-capacity tape units available from Maynard, Genoa, Mountain, Everex, and others.

BACKUP VALUE The quality of backup software can be as important to getting backups made regularly as the hardware. Indeed, in the case of backup software intended to replace DOS's relatively primitive commands for backing up to floppy disks, all you're buying is increased speed, convenience, and data integrity.

Features such as detecting unformatted disks and formatting them, or allowing the use of two floppy disk drives where available—to reduce time lost to disk swapping—can make all the difference in speeding up a job no one enjoys. My favorite touch is a little on-screen digital

QUICK-AND-DIRTY BACKUPS

Though nothing short of making regular, full backups of your hard disk really qualifies as protection against disk disasters, there are several quick-and-dirty backup tricks that can provide reassurance and security for really important files between backups.

One of my favorites on PC AT–class machines is to use that otherwise almost-forgotten 1.2MB floppy disk drive in the machine for quick, spontaneous backups as you're working on important files. (This works just as well with the 1.44MB high-capacity microfloppies on PS/2s, of course.)

Since modern hard-disk-equipped PCs invariably boot from the hard disk drive, you probably don't use that drive for much beyond loading new software onto your hard disk and making the occasional floppy disk copy of a file to pass on to a friend or coworker. Indeed, I find that many owners who have PCs equipped with 1.2MB floppy disk drives don't even keep 1.2MB disks around. They use floppy disks so seldom that it hardly matters—and they are often put off by the price of a 1.2MB floppy, which is awfully expensive if you're just putting a couple of small files on the disk.

I do keep 1.2MB disks around, using them almost exclusively for my Q&D backups. When I'm working on anything at all important, I keep one of those 1.2MB floppies in drive A:. Then as I work, I periodically dump the file to that floppy disk.

Because I like to keep successive versions of my half-finished text files and evolving spreadsheets and growing databases, I make successive saves to that same floppy under slightly different names (such as 88EDCAL1.WK1, 88EDCAL2.WK1, and so forth), so that if I find I've made an incredibly bonehead mistake and wiped out a couple of hours' worth of work, I can always revert to that last version, rather than dealing with the hassle of rebuilding the file from scratch.

As these quick-and-dirty 1.2MB floppy backups grow to fill the disk, I don't just erase and reuse the floppy. Instead, I number them successively, then toss 'em in a disk box. At any time I have 10 or 15 disks in that box, representing Q&D backups of important work over the past 3 or 4 months. Endlessly reusing the same disk for these backups is false economy: at least a dozen times I've been saved by a file on one of those old Q&D backup disks.

One of my favorite tricks on PC AT–class machines is to use that otherwise almost-forgotten 1.2MB floppy disk drive in the machine for quick, spontaneous backups as you're working on important files.

Unfortunately, you can't just leave that high-capacity disk in drive A: all the time, because as the machine starts its boot-up process, the code in the boot ROM looks first to drive A: for a disk with DOS. If it finds a disk there but not one with DOS on it, it doesn't look to drive C: but simply stops, warning you that there's a nonsystem disk in that drive. So you'll have to pull your Q&D backup disk out, then reinsert it as you end, then begin sessions at the computer. That's a small price to pay for the kind of security these handy interim backups provide.

Don't rely on ad hoc solutions like this to take care of all your backup needs. But for those really important files, especially between full-scale image or file-by-file backups, they can save your posterior.—**Jim Seymour**

clock in *PC-FullBak*, which nags you to pay attention and get this over with by cattily pointing out how long the program has had to wait for you to swap those floppies.

Nowhere is the importance of good software more evident than in the tape backup market. Since most vendors use one of a handful of common tape drives—typically those from Archive, Alloy, Cipher, and Wangtek—the value added by backup unit suppliers lies mainly in the packaging, documentation, and software that come with the drive.

The software supplied with Genoa's Galaxy backup units has a particularly good reputation for ease of use and reliability. For those who want every possible option in an expert mode, or simple push-a-button operation in the novice mode, the SY TOS software, supplied by several tape backup unit manufacturers, offers both a rich range of options in its expert mode and an easy-to-use novice mode with the most common defaults.

In tape backup software, look for both menu operation and the ability to use a command-line approach (or a functionally similar command-file system), so you can automate backups. Look for software that not only supports image versus file-by-file backups but adds intelligence to those options, such as allowing easy tagging of files that should *not* be copied, or permitting individual file restoration from image backups.

Finally, look especially for programs that deliver on the universal promise of speed. The combination of faster data-transfer rates (especially with up-to-date interfaces to the PS/2's Micro Channel architecture bus) and clean, precise tape-handling is realized in many of the backup units that were reviewed in the pages that follow.

Hard disk backup is still a messy job, and somebody's gotta do it. This year's crop of tape backup units and new and updated floppy disk backup software don't make the job fun, but they do make it possible to get it over with a lot sooner.

And that may be what it takes, finally, to persuade more of us that backing up our hard disks is a good idea. PC

Jim Seymour is a contributing editor of PC Magazine.

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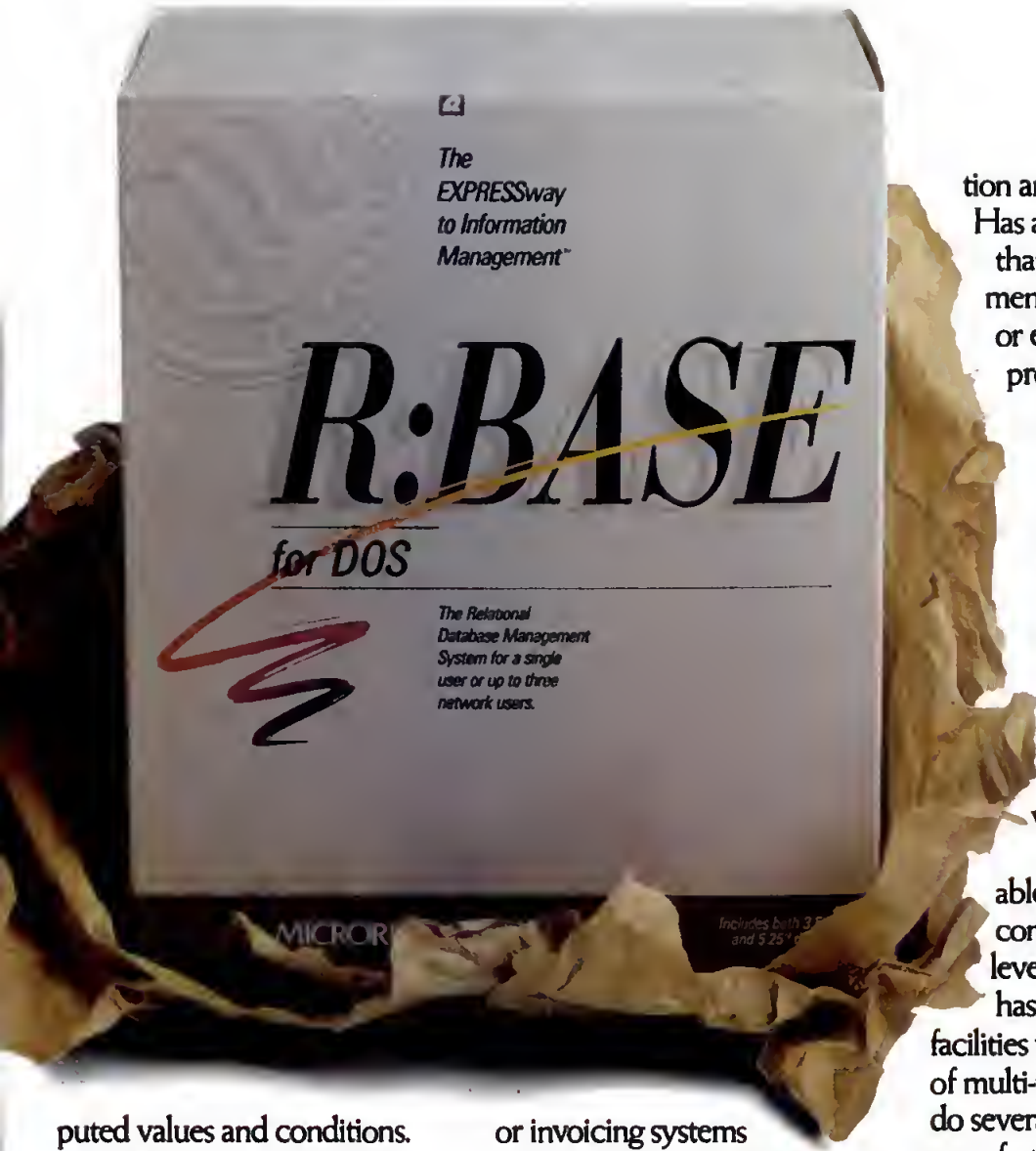

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SOFTWARE SAFETY NETS

Backup software manufacturers are meeting the challenge of complicated data management with programs that reduce the pain and increase the gain.

IT'S A SEESAW BATTLE WITH NO end in sight. Backup programs for PCs are getting better. But the jobs they have to do are getting tougher.

MORE FLEXIBILITY New programs and new versions are increasingly flexible, allowing much closer selection of files to be backed up and restored. They are adopting improvements in user interfaces—clearer menu structures, better help functions, more self-configuring processes. And they are adapting to technological changes—high-capacity 3½-inch drives, Bernoulli Boxes, and other multimegabyte cartridge drives. But backup software has to meet increasingly difficult challenges:

- Hard disks are getting bigger. As the 386s come in and PC-based local area networks spread out, the size of hard disks for PCs is increasing—devices over 100MB are becoming widespread, and there's no visible upper limit.
- As PCs move into the workplace, the data stored on them becomes more and more vital to the life of the business. Reliability, portability, and the intelligence to reconcile varying versions become crucial.
- As the technology and engineering of PCs become more involved, the backup jobs get more involved, too—LAN servers, RAMdisks. The range of storage devices that can be recognized by DOS as "legal" and assigned a drive letter is

breathtaking. And the compatibility problems they can create for backup software are equally breathtaking.

The role of backup software is broadening as well. "Backup" is something besides disaster recovery—increasingly it means some kind of automated help for users who must manage large numbers of files on large storage devices. This can mean creating an audit trail of successive versions of a set of files; having the computer help make sure all the files parked in temporary storage, like a RAMdisk, are moved to a safe place; creating duplicate sets of files—for distribution via "sneakernets," for instance, or to mirror part of a desktop machine's hard disk to a laptop.

The backup programs that best meet these challenges must be extremely flexible, both in terms of the kinds of backup they do and the way they present themselves to users. Yet this sophistication can't come at the expense of speed and ease of use. If it does, the program won't be used.

Price shouldn't keep anybody from using backup software. As the accompanying table "Backup Software: Summary of Features" shows, even the more costly backup packages reviewed here are inexpensive, compared with other applications that get daily use. (Neither is price an indicator of the flexibility of the package, as the table also shows.)

Many of the programs get their speed of operation out of monkeying around with the disk format and the way they write data to disk. Those programs that use proprietary formats generally fill a backup disk much more quickly than the programs that use DOS disks—a major consideration for users who do frequent backups of all their files. But the trade-off comes in the restore process. The pokiest of the DOS-format programs slavishly copy all the subdirectory structure and files of the original, so a user can find and restore a few individual files with an ease that the proprietary-format programs, which must decode the stored files, can't match. The proprietary formats make possible some error checking that the DOS programs can't match, however, and in extensive restore operations their speed is a real advantage.

Most of the backup programs are keeping pace with the proliferation of storage device formats—3½-inch drives, cartridge drives, virtual drives on network servers. A few of the applications even add a format of their own, allowing a double-density disk to be formatted in the 80-track drives found on ATs and to hold 720K of data.

All the backup programs do a full backup of all the files on a DOS device and partial backups of some sort (a single subdirectory, a subdirectory and its dependent directories, or wildcard file matches). Most will do incremental backups of all the files with their archive bit set (the archive bit is a single-bit flag in the file's header that is set "on" by DOS when the file is created or modified, and "off" by a backup program).

What the programs do is often secondary to *how* they do it. Something that is simple for one program, like backing up all the .WK1 files in a subdirectory, may require reconfiguration in another. Generally the programs deal well with full and incremental backups, but the fancier things get (lists of files or subdirectories to be included or excluded, or wildcard file selections), the more difficult they are to set up.

ELABORATE SCENARIOS Some programs make these more-difficult procedures easier by allowing users to create different versions of a configuration file for the program, and to save lists of files and subdirectories to be included in or excluded from backups. Most allow the backup program to be run from the DOS command line. The combination of file-driven operation and DOS-prompt commands means that some programs will allow elaborate backup scenarios to be run from simple batch files.

Some programs provide more information on the backup process than others. One of the best features (but not necessarily the most common) is an estimate given before you start the backup of just how many disks and how much time you will need to complete a particular job.

"Backup" increasingly means some kind of automated help for users who must manage large numbers of files on large storage devices.

The more-robust programs offer a "read after write" verification option, which reads the newly written data from the backup disk, compares it with the original file, and warns of any discrepancies. The simpler programs handle verification as a pseudo-restore—the user feeds the backup disks to the program and it compares files to the originals rather than overwriting them. "Read after write" verification slows a backup down drastically. The manual verification procedure of the smaller programs means more disk handling, but takes little longer to achieve the same degree of certainty provided by the glitzier packages.

Unfortunately, the restore capabilities of most of the programs tested are not as rich as their backup options. This makes some sense, because restores are done much less often than backups, but it limits the usefulness of the software as a disk management tool.

Most programs still insist that a file must be restored within the same directory from which it was backed up—and a couple even insist on the same drive.

The programs vary in their handling of system files. Some will back up and restore the three system .COM files, others

OUR REVIEWERS

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David DeJean is a longtime computer user who has written about business and technology for major magazines and newspapers.
Henry Fersko-Weiss is a science and technology writer and frequent contributor to *PC Magazine*.

will not. The issue here is keeping an incompatible version of DOS from being inadvertently loaded onto a computer—a detail, but a potentially troubling one.

Several of the backup programs sport graphical directory tree-diagrams to help users select files and subdirectories for backups or restores. This may be because they are a help to users (which they are), or they may be a response to backup software's expanding uses in disk maintenance. Or they may be another outbreak of the Swiss Army knife marketing theory—add tools to the kit, add bucks to the price. Whatever the reason, in a couple of the packages these capabilities have been expanded into more-generalized disk maintenance utilities. In a few instances—*PC Tools Deluxe* and *JetDrive*—the backup functions aren't even the centerpiece of the package.

In an increasingly crowded marketplace, some degree of specialization is evident—the elaborate logs of *Bakup*, the real-time automatic backup of *BackTrack*. The wide variety of functions means that PC users faced with decisions on backup can consider the available programs within this framework: how much disaster do they want to be able to recover from, and how much time and effort are they willing to lay out, in small daily payments in advance, to get that protection?

—David DeJean

Back-It

Gazelle Systems' recent changes in *Back-It* have moved the program into the big leagues of backup software. *Back-It*, Version 3.0, has speed, excellent error protection, and a host of user-selectable options. And the new $129.95 version greatly enhances the program's flexibility in what it will back up and how it can be run.

Back-It hasn't broken completely with its past. Its menu screen still has more going on than a three-ring circus. Pop-up windows cover up things you might want to read, while other things that don't need to be on-screen remain there, immovable.

This busyness extends to *Back-It*'s operation. The program imposes a lot of bustle on a backup or restore—its user interface doesn't make it easy to do what's most frequently done. To do a full restore, for instance, you have to call up a directory map and mark all subdirectories for backup, then return to the main menu to set other parameters in no particular order. The presentation doesn't benefit from comparison with the orderly, consistent menus of a program like *Corefast*.

But *Back-It* does let you do just about any kind of backup, and in a couple of different ways. "Presets" let you configure the program and set specifications for files to be backed up, even using the "Specify" option to select ten file specifications for inclusion and ten for exclusion in a backup, with wildcards allowed. The "preset" can be saved under a filename and reloaded. *Back-It* can also be run from the DOS command line. Taken together, presets and command-line operation mean that *Back-It* can run some very complicated backups from some very simple batch files.

The program's flexibility is matched by a wonderful resiliency. There isn't much that *Back-It* can't cope with. It handles errors very well and gives clear messages to its users. Its automatic error correction during restores works well. It refuses to deal with a faulty floppy disk—either to format a new one or use one that has already been formatted in a backup. *Back-It* deals equally well with pilot error: while other backup programs simply die if a drive door is opened at the wrong time, *Back-It* may slow down and start reformatting the disk as it goes, but it keeps going. Backups and restores can be interrupted on purpose as well, something few backup programs allow.

Back-It can be run using a proprietary disk format or DOS-formatted disks. In DOS-format mode it is compatible with the range of DOS devices that can be assigned drive letters—hard disks, cartridge drives, even LANs. In its proprietary mode, *Back-It* is among the faster backup programs. It handled the Bigfile test with dispatch, but it failed in the face of the Scatter test, because it does not handle more than 200 subdirectories in one operation. While this is a drawback, only you can decide how serious it is—few users are likely to make the demands on a backup package made by the Scatter environment, with its 1,500 subdirectories.

Back-It deserves some credit for being up-front about its shortcomings. A page in its excellent manual is headed "Limitations"—something *every* program's manual should have—but aside from the 200-directory limit, none of the items on the brief list is major. Its speed, error handling, and wide variety of options make *Back-It* a program to be taken seriously.

—David DeJean

PC MAGAZINE FACT FILE

Back-It
Gazelle Systems
42 N. University Ave., #10
Provo, UT 84601
(801) 377-1288
List Price: $129.95
Requires: 256K RAM, one floppy disk drive, a mass storage device, DOS 2.0 or later.
In Short: *Back-It* has it all—speed, features, flexible operation. Its only drawback is an interface that fails to organize the program's power but tries to give it to the user all at once. Not copy protected.

CIRCLE 665 ON READER SERVICE CARD

BackRest

Many things can happen in 3 years, and many things can stay the same—witness Stok Software's *BackRest*. A capable but limited and pokey backup program selling for $180, *BackRest* is stuck in 1985.

You can't sit back and rest, as *BackRest*'s developers apparently have been doing, while *BackRest* backs up the layers of directories on your hard disk automatically. You must enter the paths manually, at least the first time you use it and whenever you add or delete paths.

This tedious requirement in a program that's otherwise easy to use means that *BackRest* couldn't handle one of PC Labs' backup and restore tests automatically, unless we spent a lot of time entering all the paths on our hard disk. So if your hard disk harbors intricate layers of up to 1,500 subdirectories, you'll rest no easier at night with *BackRest* handling your backups. In fact, you'll be up all night entering paths and otherwise telling *BackRest* where to go, in no uncertain terms.

PC MAGAZINE FACT FILE

BackRest
Stok Software Inc.
92-30 56th Ave.
Elmhurst, NY 11373
(718) 699-9393
List Price: $180
Requires: 256K RAM, IBM PC/XT/AT or compatible, DOS 1.0 or later.
In Short: This outdated program is just not automated enough; you must enter all the paths on hard disk into a control file that *BackRest* uses each time you want to back up or restore your files—fine for simple, unchanging hard disk structures but not for handling a thousand and a half, or even a few hundred, intricately arranged files. Not copy protected.

CIRCLE 664 ON READER SERVICE CARD

If your paths remain fairly unchanged and you entered them when you installed *BackRest*, you'll be in better shape—unless you have a 10MB file to back up. When we asked *BackRest* to back up PC Labs' Bigfile, we had to call it quits when the program failed to fill up even one floppy disk. We spent a tedious 10 minutes waiting for *BackRest* to tell us to insert a new disk before deciding to abort the test.

The well-written but poorly designed manual (48 unadorned pages) tells you that *BackRest* can store your files under the same subdirectories on your backup disks as well as restore them to the subdirectories from which it copied them. The catch is that you must indicate the subdirectories with the PATH: control record. That means typing them into the control file, which handles records controlling *BackRest*'s operation. It's where you tell *BackRest* about your monitor, printer, reporting needs, files to treat as exceptions, and destination and source drives (control records, which require typing in all your paths). *BackRest* uses the control file each time you tell it to back up or restore files.

To change it after it's set up, you must use a word processor or text editor. To start the program normally, just type Back for backup or Rest for restore. *BackRest* springs into action, completing its work with a report telling you the results.

BackRest has been around since 1982, for use on both CP/M and DOS systems. We reviewed Release 2.1 of the MS-DOS version, vintage 1985. It offers easy installation, creating the control file to set parameters and tailor the backup. In addition to backing up only those files created or modified since the previous backup, the program produces reports and traps errors.

Although *BackRest* is fine for users who have relatively few paths on their hard disks and can set up the control file once and for all, and for users with small files, it's just not state-of-the-art fast backup. After all, this is 1988.—**Carol Olsen Day**

BackTrack

BackTrack is the answer to a paranoid's prayer: RAM-resident and automatic, it wakes up to back up files either at specified intervals or by time of day. *BackTrack* doesn't depend on mere mortals to defend data against disaster. Save a spreadsheet file, exit to the DOS prompt, and then go for coffee—15 seconds later *BackTrack* will write that file to the backup device.

If that device is a floppy disk drive and there are large numbers of files to back up, someone needs to be around to change disks. The program operates most conveniently with a tape-backup unit that doesn't need such attention—it's no coincidence that it comes from Tallgrass, a maker of tape drives.

BackTrack does not operate in background mode. Instead it lies dormant in memory until the keyboard has been idle for a specified time, then takes control of the machine to back up whatever files it can before the keyboard is used again. This works infallibly at the DOS command line, but because some programs hide the keyboard from the operating system, *BackTrack* may never wake up inside some applications.

Even at its loss-leader pricing of $39.95, *BackTrack* doesn't come for free. One of its costs is the 52K of memory it takes up. Another is the time it takes: the program uses DOS-formatted disks and does little more than serve as front end for the DOS BACKUP function, the slowest possible way to back up files. Thus *BackTrack* preserves directory structures on the backup disks and the files are saved unencrypted; but for backing up all the files in individual subdirectories, COPY is actually faster. It can take 5 minutes for *BackTrack* to fill a 1.2MB floppy disk during a full backup.

But full backups, which must be started manually, are not this program's strong suit. What it's best at is the automated mirroring of new and modified files to a backup device. It does this with some flexibility. A user can, for instance, set up multiple configurations of *BackTrack* and run them selectively, yielding a set of backup disks devoted to spreadsheet files that is separate from backups of word processor files.

Flexibility means complexity, though: run in RAM-resident mode to back up to a floppy disk drive, *BackTrack* virtually requires that a backup disk be in the drive all the time. Every other use for that dedicated drive must then be treated as an exception to normal operation. *BackTrack* must be suspended while the drive is used to load a program or write out a file, then restarted when the process is finished.

This complexity of operation is matched by other aspects of *BackTrack*. The program's menu-driven interface is also complex; the setup process is even less easily understood; and, while the documentation attempts to deal with the program point by point, it leaves a new user with the feeling that the only thing one can do is hold one's breath and jump in.

Other programs—almost *any* other program—make it easier to back up a single subdirectory and its dependent directories.

PC MAGAZINE FACT FILE

BackTrack
Tallgrass Technologies Corp.
11100 W. 82nd St.
Overland Park, KS 66214
(913) 492-6002
List Price: $39.95
Requires: 256K RAM, one floppy disk drive, a mass storage device, DOS 2.0 or later.
In Short: A RAM-resident program with a specialty: it painlessly, automatically backs up new and modified files as they are created. Great for RAMdisks. Not copy protected.

CIRCLE 663 ON READER SERVICE CARD

But *BackTrack* will be enthusiastically adopted by users who will use it for creating file-by-file time-stamped audit trails of their computer use, for painlessly collecting myriads of small note files—and especially for insuring that files written to RAMdisks get put away safely in more durable storage.—**David DeJean**

Bakup

Backing up data requires discipline to be effective. But does it require as much discipline as *Bakup* dishes out?

There's a whips-and-black-leather feeling about Software Integration's *Bakup:* it will do the job, and if the job it does happens to be the job you wanted, fine. If you wanted something different, *you*, user, should shape up.

Bakup, which costs $179.95, does backups of full disks or individual subdirectories; it also backs up either all files or only new and modified files. It does these four things with a minimum of keystrokes, which is good. It will run a backup either from its menus or from the DOS command line. But doing anything fancier gets tough.

Bakup is finicky from the beginning. It insists on installing itself on your hard disk. The installation process runs the DOS program, CHKDSK, and if *Bakup* thinks it is getting back a report of errors, it aborts the install. During testing, the program refused to install itself on one IBM PC AT, although a CHKDSK run outside the install program gave the hard disk a clean bill of health. Installed on a second AT, *Bakup* successfully backed up the test file Bigfile, but attempts to restore it ended amid error messages about the hard disk drive's "BIOS Parameter Block."

Bakup has its own way about most things. It is easy to begin a backup operation by mistake, but hard to stop it: *Bakup* won't give control of the machine back to you until it has cataloged the disk to be backed up, which can take a while for a full disk. And *Bakup* would not back up the Scatter test files. It posted a "subdirectory not found" error message, but only after a dozen minutes of cataloging the data structure, before the backup process had begun.

Bakup is a true archiving program. It maintains a database of files backed up and the diskettes on which they are stored, and writes this catalog on the last disk used in every backup. It will let you choose among versions of a program in a restore. It stores backed-up files on disk in a readable fashion, grouped in subdirectories—so finding and retrieving an individual item can be easier than with other programs that use a DOS-format disk but dump everything that goes onto the disk into one big file. But there's a stiff price to be paid for this convenience in the time and number of disks it takes to do a backup.

Like all good librarians, *Bakup* has strict rules about checking things in and out. Its backup disks are numbered and carefully tracked by the program (50 prenumbered labels are provided). Woe be to the user who tries to append a backup of modified files to a diskette that *Bakup* isn't expecting to see in the drive. The shrill alarm the program sounds is something no user wants to hear twice.

Is all this discipline worth it? If the reason for backing up is to recover, completely, from that head crash that turns jewel-like machinery to junk, then the obedience *Bakup* demands is indeed worth it. But if the reason for backing up is primarily to pull off the very occasional irreplaceable file for safekeeping, and perhaps to ease the pain of having to reload applications after a careless keystroke erases a directory, then there are more relaxed ways to go. —**David DeJean**

PC MAGAZINE FACT FILE

Bakup
Software Integration Inc.
9800 Sepulveda Blvd.
Los Angeles, CA 90045
(213) 776-3404
List Price: $179.95
Requires: 256K RAM, one floppy disk drive, a hard disk, DOS 2.0 or later.
In Short: *Bakup* takes a thoroughgoing approach to archiving files and indexing the disks that hold them, but its storage scheme costs extra time and disks, and the program rigidly imposes its own way of doing things on the user. Not copy protected.

CIRCLE 662 ON READER SERVICE CARD

Corefast

Most backup programs are family sedans—not very exciting, but more or less useful. *Corefast* is a sports car—a great deal of power in a very attractive package.

Whatever the backup task, the $149 program gives evidence that its creators at Core International have thought about it. They've not just made the task possible but have integrated it smoothly into the program's function—and made those functions accessible at several levels of operation, from beginner to past master.

Corefast's menus, clear and well organized, offer program functions well separated from system configuration tasks. But the program also can be run from the DOS command line to perform the most common backup and restore tasks. Its capability to work from "catalogs" of subdirectories and files adds great flexibility to the program and means that batch-file jockeys can automate even the most complicated of backup jobs.

Careful attention to *Corefast*'s use on a network indicates an understanding of the users and what they're using the software for. *Corefast* will back up a Novell network, including all the hidden files, if the user has proper system authorization.

Corefast will back up to any device recognized by DOS—cartridge drive, hard disk drive, and any type of floppy disk likely to be found on a DOS machine, in-

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

Corefast
Core International Inc.
7171 N. Federal Hwy.
Boca Raton, FL 33421
(305) 997-6044
List Price: $149
Requires: 256K RAM, one floppy disk drive, a mass storage device or virtual drive on a network, DOS 2.0 or later.
In Short: *Corefast*'s ease of operation and powerful "catalog" feature for creating lists of directories and files to be backed up or restored set it apart from the rest. Its only major weakness is its poor handling of errors. Not copy protected.

CIRCLE 661 ON READER SERVICE CARD

THE GENERATIONAL BACKUP SYSTEM

A neat backup trick well established in the big-computer world can multiply your protection against data loss.

The principle is simple: save several successive generations of backups. This is often called a "grandfather/father/son" system, recognizing the generational nature of the backup series.

Let's say you decide to make weekly backups of the hard disk in the PC used in your office for accounting records. So you begin at the end of week 1 by making a full-image backup of everything on that disk. At the end of week 2, you make another full backup—but not on the same floppy disk, cartridge, or whatever media you're using. Instead, use a second set of floppies or a new tape for the week 2 backup. Ditto for week 3: don't go back and erase (or record over) the floppies or tapes from the first 2 weeks' backups, but instead use another new set of disks or another new tape.

You now have 3 successive weeks' sets of backups. Each is a whole, complete record of the state of that hard disk at the end of weeks 1, 2, and 3. Think of those three tapes as a grandfather, father, and son.

Now comes backup time at the end of week 4. This time get out the set of floppies or the tape used for week 1, and reuse them. That will wipe out everything recorded on those disks or tape, but will maintain your pattern of a rolling, 3-week set of backups.

Then each succeeding week, always take the *oldest* of the set of three backups down off the shelf and use it for the current backup.

Why all the bother? Isn't that wasting an awful lot of floppy disks or tapes?

The fact is that even with the best backup software and hardware, you can occasionally produce backups that just won't restore after a hard disk disaster. Keep reusing the same set of backup media every time, and you'll tear your hair out the day you need to use them but find they don't work. A set of three successive backups dramatically increases the odds that you'll be able to find one that works.

It also protects you against disasters involving loss, theft, or damage to a backup set.

Sounds simple, doesn't it? It is—and yet you'd be surprised at how many PC users who do go to the trouble of making regular backups undermine their security by keeping only *one* set of backup records.—**Jim Seymour**

cluding the PS/2's 1.44MB drives. Particularly nice is a mode that uses the 80-track capability of an AT 1.2MB drive to squeeze 800K of data onto a double-density disk that would otherwise hold only 360K.

Corefast's high-speed disk backup, which writes to floppies in a proprietary format, is fast and accurate and tough enough for the big jobs. The program wasn't bothered a bit by the Bigfile and Scatter tests. It was one of the few programs that would stand up to the complexities of Scatter's multilevel directory structure.

But although "big" doesn't bother *Corefast*, "bad" gives it real grief. Recovery and error handling, in fact, are this program's weakest spots. *Corefast* won't balk at a bad diskette until it's too late: it will format one, or let one be used in a backup. The error message won't come until the program tries to restore data from the damaged floppy, which is far too late. *Corefast* doesn't tolerate pilot error very well, either. A disk-drive door opened at the wrong time during a backup drops the user back to the DOS prompt, and several minutes of work are down the drain.

Fortunately such problems are rare, and when things are going well, no backup program goes better than this one. The thought that has gone into the product shows in the details as well—the context-sensitive help, the very usable documentation. *Corefast* is easy to start with, powerful enough to stay with.—**David DeJean**

DS Backup Plus

DS Backup Plus is a well-organized menu-driven program. It is so easy to use that a manual is almost unnecessary. The program backs up in a DOS-readable format and can compress the data to save space. There is also a speedy version of the program on the same disk—called Speed-Bak—which creates a non-DOS readable backup, but only onto floppy disks. One of the program's exceptional features is its ability to stop a backup or restore in midstream and then pick up from the same spot at a later time. You can also run unattended backups if the copied files will all fit on the target media.

The *DS Backup* screen is split into four windows. The window running across the top of the screen is used to specify the source and target paths during backup or restoration. The middle of the screen is broken vertically into two windows. The left window displays basic backup information: the number of floppy disks or other media needed; the number of bytes to be

PC MAGAZINE FACT FILE

***DS Backup Plus*, Version t.t0b**
Design Software
1275 W Roosevelt Rd.
West Chicago, IL 60185
(312) 231-4540
List Price: $79 95
Requires: 256K RAM, DOS 2.0 or later.

In Short: *DS Backup Plus* is a very flexible, easy-to-run program. It can be operated by menus or commands at the DOS prompt. It can back up either an entire system or only files that have changed, and it can selectively back up tagged directories. The file selection criteria are rather limiting and can be awkward. One outstanding feature is the ability to interrupt a backup and resume it later exactly where you left off. Other features include a backup analysis, unattended operation, and the ability to sort files on backup. Not copy protected.

CIRCLE 660 ON READER SERVICE CARD

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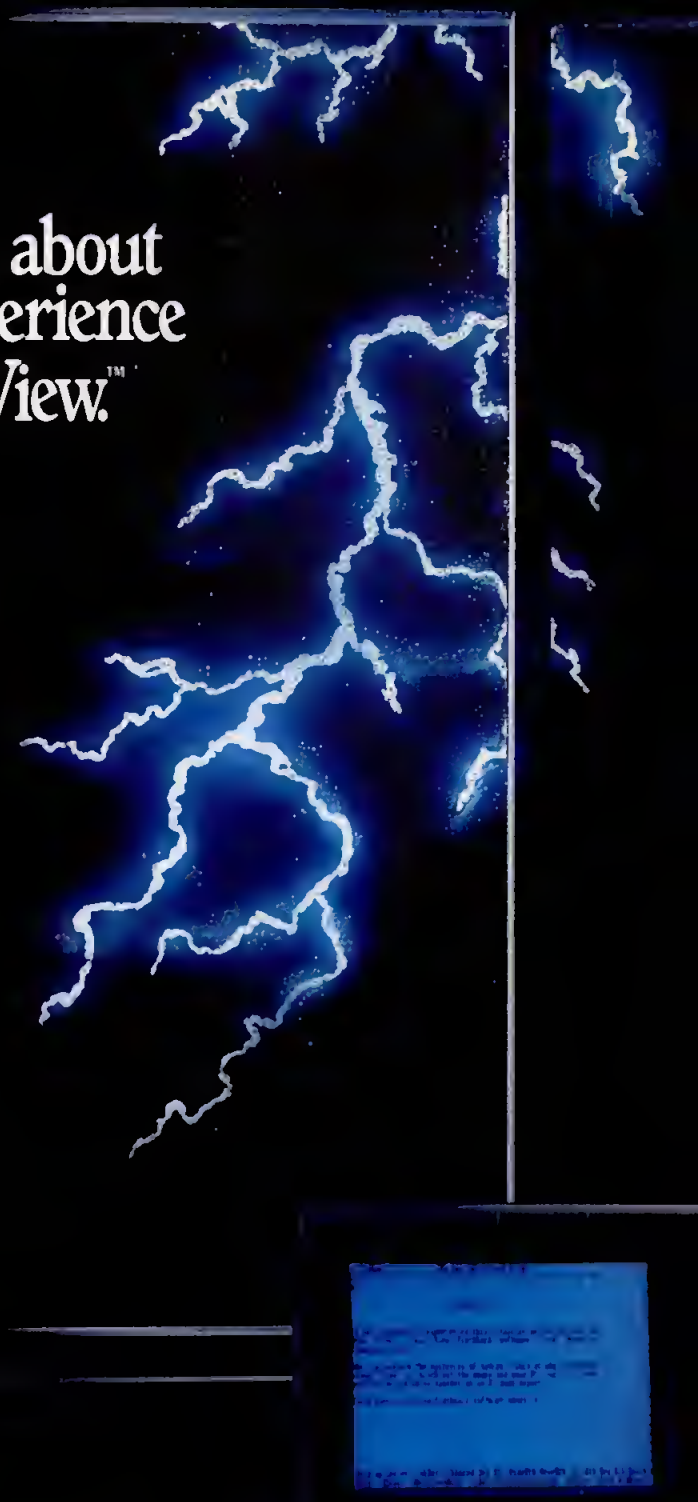

Who can explain the mysteries of nature? Such as why lightning always seems to blackout the power and your PC, just as you're putting the finishing keystrokes on an 87-page report?

That's where Deja View™ flash-back software comes in.

Deja View runs on your IBM PC, PS/2 or compatible, automatically protecting your work in progress from power failures and surges. Accidentally pulled plugs. Frozen keyboards. System crashes. Unintentional reboots. Inadvertently deleted information on your screen. And a thousand other potential disasters.

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Deja View is a non-copy-protected, memory-resident utility that runs along with your application program. It automatically copies all of your PC's RAM and video memory onto your hard disk, saving your work in progress. You decide the frequency of the Auto-Save function, by number of keystrokes or specified time intervals. Or use the Save-Now key as needed.

Deja View also lets you flip back and forth between two different applications by depressing just three keys. You don't need to save work files, exit one application, and then load the new application and work files.

Now there's no need to buy an expensive battery back-up system. With a price of only $95, can you really afford to be without Deja View?

So call Meridian Technology today, or see your local dealer. And if disaster should strike, you'll know your work in progress is safe. And you'll be glad you've experienced Deja View.

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7 Corporate Park, Suite 100
Irvine, CA 92714. (714) 261-1199

CIRCLE 107 ON READER SERVICE CARD

backed up; the backup type; and certain options such as verify, report, and subdirectories. The right window is the main menu. It contains the basic operational choices, including Backup, Restore, Options, Filespecs, and so on. Each of these choices will pop up the next menu layer, or an input screen, in the main menu window. This window also displays progress data during a backup. The last window—filling the bottom third of the screen—shows a list of the files in the directory entered in the top window.

DS Backup Plus is a well-organized menu-driven program. It is so easy to use that a manual is almost unnecessary.

When doing a backup of your entire system, you can choose to verify the backup, produce a report, back up only changed files, include hidden files, back up by date, and compress the data. You can also specify up to four volumes to back up in sequential order.

If you want to be more selective, you can back up particular directories and files. You do this by using the "Choose directories" command on the Options menu. Two windows pop up and overlay the entire screen, except for the source and target window at the top. One window has a tree diagram of your hard disk and the other displays filenames for each directory as you scroll through the tree. After tagging directories you can pick individual files through the Filespecs command. The Filespecs window gives you 16 lines to fill in with filenames or wildcard designations. In this way you can include or exclude particular files or groups of files. But Filespecs is rather limiting and can be awkward. If you use a wildcard, it will be applied to the whole hard disk—or all the directories you've selected—not to an individual directory. And if you use filenames, you can choose a total of only 16 files for the entire hard disk.

As the program is backing up your system, the number of the floppy disk is displayed on the screen. *DS Backup* also displays a running update on the time the backup is taking, the percentage complete, and the percentage full for the floppy. If you want to interrupt a backup or restore, all you do is hit Esc. Then, you can return to DOS and run any application, returning to the backup whenever you like. A Resume command will continue the interrupted operation at exactly the point you left off. This feature is terrific for accommodating the unexpected—like a report that has to be run immediately.

DS Backup has several other interesting features. A backup analysis will tell you the number of files changed and the percent of bytes changed in the files so that you can decide how necessary a backup is. You can run unattended backups if all the files will fit on one target volume. You can also sort files while backing them up. There is an on-line help facility, and *DS Backup* can be run from the command line, bypassing the menus. With all these features it is a rather flexible, easy-to-run program.—**Henry Fersko-Weiss**

Fastback Plus

A better name for *Fastback Plus*, from Fifth Generation Systems for $189, would be "Fastback Ne Plus Ultra." It's hard to find another backup program so plus and ultra.

Fastback Plus is not only more flexible and more powerful than its predecessor, *Fastback* (*PC Magazine*, October 27, 1987, page 335, and April 28, 1987, page 272), but it's easier to use. You can adapt the program's pull-down user interface to suit either novice or expert user. Simply make a few choices from the menus, and you're in Backup City.

Features new to this version include enhanced error correction, data compression, DOS-compatible disk format, support for any logical DOS device, multiple include/exclude file specs, a directory-tree display to choose from, recovery from damaged disks, and built-in macros. Add those features to context-sensitive help, incremental or full backups, control over archive flags, a DOS shell, automatic formatting of disks, estimates of backup time and the number of disks required, and reassuring feedback as *Fastback Plus* goes quickly about its work. The result is a powerful, easy-to-use, state-of-the-art backup program that both new and advanced users will welcome using.

Installing *Fastback Plus* is a breeze. Using it is even breezier as you choose options from the menus. The manual—a compact paperback—is super, but *Fastback Plus* is so easy to use that we could perform the PC Labs benchmark tests without consulting the manual.

The testing procedures and the test results were proof that *Fastback Plus* is both flexible and powerful. If you choose Estimate, the program shows you all the directories on your hard disk and then scans them to tell you the files, kilobytes, volumes (disks), time, and speed info for the backup. After the program starts the backup, your only job is to feed it the required disks when it prompts you. The times in the benchmark charts include disk formatting, error correction (optional), and archive control—a lot of goodies for only a brief span of time.

FACT FILE

***Fastback Plus*, Version 1.01**
Fifth Generation Systems Inc.
11200 Industriplex Blvd.
Baton Rouge, LA
70809-4112
(504) 291-7283

List Price: $189; $45 for users who purchased program before September 1, 1987; $20 for those who purchased it after then and can show proof of purchase.
Requires: 448K RAM, IBM PC/XT/AT, PS/2, or compatible; DOS 2.1 or later.
In Short: The ne plus ultra of fast backup programs. *Fastback Plus* offers pull-down menus, a directory tree display, disk formatting, error correction, data compression, incremental and differential backups, and more—all to one effect: fast, safe, easy backups. A powerful macro feature automates operations even further. All you have to do is make menu choices and keep those disks moving. Not copy protected.

CIRCLE 659 ON READER SERVICE CARD

Funk's new 1-2-3 Performance Software

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PC MAGAZINE

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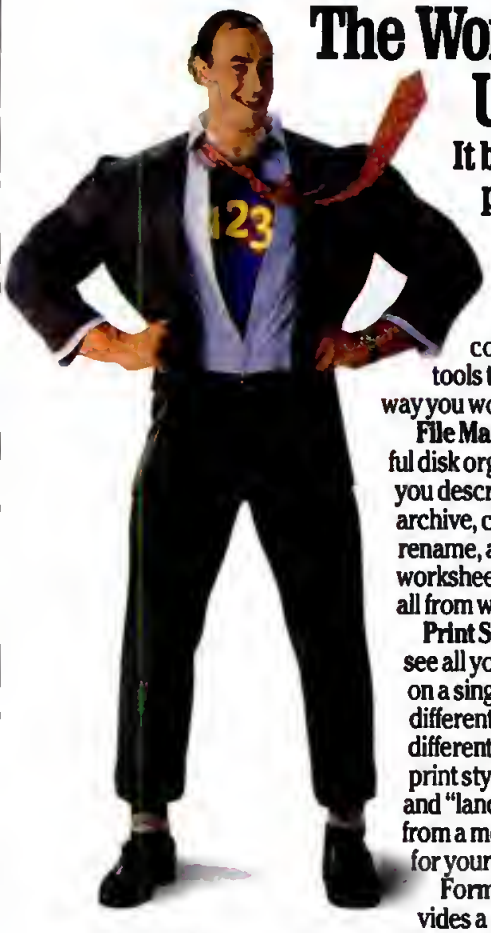

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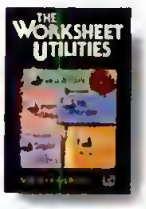

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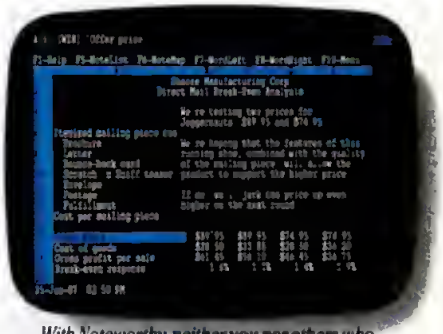

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CIRCLE 323 ON READER SERVICE CARD

Fifth Generation Systems calls *Fastback Plus* the next generation of backup software, but it's not resting on its pluses. A new upgrade, in fact, should be on the market by the time you read this review. *Fastback Plus* seems determined to remain the ne plus ultra of fast backup programs.—**Carol Olsen Day**

Fullback

Working with ALPS's *Fullback* is very much like working with DOS. The $129 program is stripped down to the barest necessities; commands are issued at the drive prompt; and it is somewhat slow. But it is also extremely simple to learn and use, as well as flexible.

Actually, *Fullback* is not one discrete program, but rather a grab bag of eight programs. Two are full backup programs; the other six are associated utilities.

The namesake of the group, Fullback, must be used if you are backing up to any medium other than floppy disks. It enables you to back up files by subdirectories. Each subdirectory is copied to one floppy disk, and if a subdirectory is too large for a single floppy, it must be broken up using the Ctlback utility.

There is logic behind this piecemeal approach to backing up directories. You know exactly which diskette contains each file. Then, when you back up changed files, you know exactly which diskette to load. It prevents you from having different copies of the same files on different backup disks. Organization is forced on you.

The other full backup program, Halfback, is much more automatic than Fullback. You don't have to worry about setting up your directories to fit on the floppies, chunk by chunk. The backup is run across disks—as long as no one file is too large to fit on a single floppy. If any files are too large, then you must use the Bigback utility, which spreads out a large file across disks.

Halfback lets you back up an entire hard disk, several directories or a single directory. While it is more automatic, it is also slower on subsequent backups because it will not respond selectively to changed or new files, as does Fullback. To find changed or new files you would use the ModDirs utility. Then you could use Halfback on the directories that contained the files identified by ModDirs. Obviously, this is a manual approach.

The other utility programs in the *Fullback* package are DirImage, which allows you to copy directory structure onto backup disks and is used with Fullback; MakeMod, which gives you control over marking files as "changed" or "not changed"; and CreatDir, which assists in creating directories when the backup volume is as large as or larger than the source volume—this might happen when two hard disks are involved.

The commands for almost all of the procedures in *Fullback* are issued at the drive prompt. They typically start off with one of the eight program names, followed by the source and destination drive letters. The Fullback, Halfback, and Bigback utilities have tiny help screens, invoked by typing the program name by itself at the drive prompt. The help screens show you how commands are written; they also list the few options, which are added to the end of a command phrase with a hyphen. Some of the utility programs use function-key commands that are displayed on the bottom of the screen.

The 50-page manual is clear and complete. In only minutes you can be backing up your overstuffed hard disk and protecting yourself from disaster. While *Fullback* is a no-frills, plain-wrapper approach to this most important function, it does offer the user a good portion of flexibility.
—**Henry Fersko-Weiss**

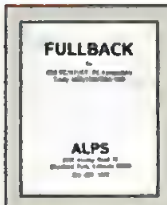
Intelligent Backup

Many backup programs neglect design, but Sterling Software Co.'s *Intelligent Backup* isn't one of them. It has an extremely attractive interface, replete with the niceties of much more complex applications. The $149.95 program is menu driven, offers context-sensitive help, has a full-screen editor, and comes wrapped in colors that you can change to your liking. You also get excellent adjunct information in every operation.

But despite this superior profile, *Intelligent Backup* has a couple of weaknesses. It isn't fast, and it can only handle about 200 directories before you have to do some awkward maneuvering to increase its capacity.

Installing the program is straightforward and nearly automatic. There are only a few prompts to respond to, one of which will change your CONFIG.SYS file if it isn't already set for 20 buffers. If you say "yes" to the question about the AUTOBACKUP feature, the program will help you add six lines to the AUTOEXEC.BAT file that will remind you to back up your

PC MAGAZINE FACT FILE



***Fullback*, Version 3.0**
ALPS
1502 County Rd. 25
Woodland Park, CO
80866
(303) 687-1442
List Price: $129
Requires: 256K RAM, DOS 2.0 or later.
In Short: *Fullback* is a group of eight programs. Two are full backup programs; the other six are utilities for smoothing out the operation. While the program is driven by typed commands at the drive prompt and has a no-frills design, it is quite flexible. Not copy protected.

CIRCLE 658 ON READER SERVICE CARD

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***Intelligent Backup*, Version 2.2Q**
Sterling Software Co.
202 E. Airport Dr., #280
San Bernardino, CA
92408
(714) 889-0226
List Price: $149.95
Requires: 320K RAM, DOS 2.0 or later.
In Short: *Intelligent Backup* is a very attractively designed program. It is menu driven, functions can be initiated by single-key designations, and the color can be customized. The backup and restore functions are flexible; the supporting information about disks, files, and procedures is excellent. But the program is somewhat slow and can handle only 200 directories until you have to increment the memory in an awkward manner. Not copy protected.

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[illegible] product is in no way [illegible] for origination in Fisher Scientific or Allied Corporation.

CIRCLE [illegible] ON READER SERVICE CARD

data each time your system is booted.

Getting around in the program is easy and fast. Program functions are initiated by using the arrow keys to move a reverse video bar up and down the screen and then pressing Enter or, in many cases, by typing the first letter of the function. On the main menu, for example, you could select the Backup function by typing "b". In addition, eight function-key commands are active from any place in the program—even in the middle of a backup. These commands let you enter a DOS command to be executed, turn the sound on or off, display the amount of free space on the current disk, and so on.

One of the best characteristics of *Intelligent Backup* is all the information that it gives you about your files.

Should you need a hand, there are more than 300 help screens in the program. They can be accessed at any point in the program or read sequentially as an on-line manual.

One of the best characteristics of *Intelligent Backup* is all the information that it gives you about your files. A File Maintenance screen, which can be tied to any drive, lists directories and subdirectories in scrollable tree order, tells you how many files have been changed, the total number of files, total size, percent of disk, the date of the last change, and the action taken. From this screen you can go even deeper and get a list of all, or selected, files within the directories. Alternatively, you could print the list or sort it in several ways. A Disk Volume Contents screen gives you aggregate information on the whole disk—number of files, characters, directories, number of bad sectors, and so on.

When you are not backing up files globally, you can select exactly which files that you want. Once they've been selected you can do a full backup (that is, you can back up the files regardless of changes), an update, or a consolidation. The Backup Level Selection screen tells you how long the backup will take, the number of floppy disks you will need, and more. While the backup is underway, two bar charts will show you how far the process has gone and how full each destination disk is. Percentage figures appear underneath the moving bars. The restore procedures are just as rich.

There are a number of other appealing features to *Intelligent Backup*. You can exclude files by age (which you set), reconcile indexes, automatically print a backup report after each run, back up multiple hard disks, and more.

Unfortunately, the program is slow. Backing up a 10-million-character file took about 11.5 minutes. The program's other shortcoming is the number of directories it can handle—200—before you have to go through a series of reboots to increment the memory size. These weaknesses, however, pale in the light of the program's excellent interface, easy operation, and thorough maintenance information.—**Henry Fersko-Weiss**

JetDrive

JetDrive is both more and less than a backup program. Originally designed as a utility for Tall Tree's JRAM boards, the $60 program creates up to four RAMdisks with 16MB of storage and aids in the transfer of data.

Its transfer ability is what makes *JetDrive* a backup program as well; its transfer talents are abundant. But the program can't do global backups, rendering it also less capable than many true backup programs. Every directory and subdirectory path must be backed up individually.

JetDrive's primary use is the transfer of multiple files on a floppy disk, hard disk, or RAMdisk to any DOS medium. Files can be transferred—or backed up—by certain criteria, such as those with changes made after a specified date, only those that have changed, only if the files are newer versions of the same file, by file list, and even if files are zero length or hidden.

FACT FILE

***JetDrive*, Version 3.50**
Tall Tree Systems
2585 E. Bayshore Rd.
Palo Alto, CA 94303
(415) 493-1980
List Price: $60
Requires: 64K RAM, DOS 2.0 or later.

In Short: *JetDrive* is a file transfer program written for use with RAMdisks. Its transfer abilities are flexible and make it a good backup and restore program, except for its inability to back up multiple subdirectories in one command. *JetDrive* also lets you create up to four RAMdisks with a total of 16MB. Not copy protected.

CIRCLE 656 ON READER SERVICE CARD

All of the program's commands are issued at the DOS prompt. The general format is JET [<source>:<filename> (if there is one) <target>:{/<option> (if there is one)]. Options are typically one-letter commands, preceded by a slash, that allow you to specify criteria. Thus, to transfer a very large file and have it spread out over a number of floppy disks, the command would read "JET c:Bigfile.txt a:/s". That's all there is to know.

As is evident, *JetDrive* is an incredibly simple program to learn and operate; its usage is explained in nine pages of the manual. The options are explained in only four pages. After using the program for a while, you can easily remember the options. But if you use it infrequently, you had better remember exactly where you put the manual, because there's no on-screen help available.

The power of *JetDrive* comes from the option statements. Besides setting date and selection criteria, you can expand a subdirectory to hold up to 512 entries, reset the archive bit of transferred files, list files about to be transferred, force the transfer of files to a target disk even if those same files already exist on the target, verify the file transfer, and more.

Besides the program's backup facilities, you can also create RAMdisks and manipulate the memory allocated to DOS. You can specify the sector, cluster, and directory size in the RAMdisks, which can

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Backup Software: Summary of Features

(Products listed in ascending price order)

	BackTrack $39.95	PC-FullBak 5¼-inch disks, $59.95 3½-inch disks, $69.95	JetDrive $60.00	PC Tools Deluxe $79.00	DS Backup Plus $79.95	SavKey $89.95	Quiksave $99.00	Fullback $129.00
FILE FORMATS								
DOS	●	○	●	○	●	●	●	●
Proprietary	○	●	○	●	●	○	○	○
TARGET DEVICE SUPPORT								
360K floppy disk drive	●	●	●	●	●	●	●	●
1.2MB floppy disk drive	●	●	●	●	●	●	●	●
1.44MB floppy disk drive	●	●	○	●	●	●	●	●
Hard disk drive	●	○	●	●	●	●	●	●
LAN server	○	○	○	○	●	●	●	●
Other DOS devices	●	○	●	●	●	●	●	●
BACKUP FEATURES								
Creates DOS-readable backup	●	○	○	○	●	●	●	●
Runs from batch file	●	●	●	●	●	●	○	●
Performs automatic backups	●	○	○	○	●	●	●	○
Saves include files	●	○	●	●	●	○	●	●
Saves exclude files	●	○	●	○	●	○	●	●
Saves command files	○	●	●	○	●	●	●	●
Prevents file overwriting	● (not read-only file)	● (not read-only file)	○	● (not read-only file)	●	● (on backup)	●	● (for full backup only)
Sets archive bit	●	Optional	○	Optional	●	● (turns it off)	●	●
Verifies backup	○	Optional	Optional	Optional	●	Optional	●	Optional
Estimates number of disks	●	○	○	○	●	● (with the DiskNeed utility)	●	●
Creates catalog on target device	● (DOS directory)	○	○	Optional	●	○	●	○
Displays disk number	○	●	○	●	●	●	●	●
RESTORE FEATURES								
Verifies restore	○	○	○	○	●	● (for the first of a series)	●	●
Restores to different directory	●	●	●	○	●	○	●	●
Restores to different device	●	●	●	●	●	●	●	●
Creates restore report	○	● (on-screen only)	○	○	○	●	●	○
Searches through catalog	●	● (lists files on-disk)	○	●	●	○	●	○
BACKUP TYPES								
Full backup	●	●	○	●	●	●	●	●
Backup by archive bit	●	●	●	●	●	●	●	●
Backup by directory	●	●	● (single directory only)	●	●	○	●	●
Backup by date	○	○	●	○	●	● (since last full backup)	●	●
Backup by date range	○	○	○	○	○	○	●	○
Backup by wildcard	●	●	● (in sub-directory)	●	●	○	●	●
Backup by filename	●	●	●	●	●	○	●	●
OTHER								
Other utilities	None	None	RAMdisk, spooler	Text editor, file and disk maintenance utilities	DOS shell, retrieve, backup analysis, directory sort	DiskNeed, customize	None	One utility creates DIR structure

—Indicates Editor's Choice ●—Yes ○—No

	Back-It	TakeTwo Manager	Corefast	Intelligent Backup	Bekap	BackRest	Fastback Plus	Pdisk
FILE FORMATS	$129.95	$139.00	$149.00	$149.95	$179.95	$180.00	$189.00	$195.00
DOS	●	●	●	●	●	●	●	●
Proprietary	●	○	●	○	○	○	○	○
TARGET DEVICE SUPPORT								
360K floppy disk drive	●	●	●	●	●	●	●	●
1.2MB floppy disk drive	●	●	●	●	●	●	●	●
1.44MB floppy disk drive	●	●	●	●	●	●	●	●
Hard disk drive	●	●	●	●	●	●	●	●
LAN server	●	●	●	●	●	●	●	●
Other DOS devices	●	●	●	●	●	●	●	●
BACKUP FEATURES								
Creates DOS-readable backup	●	●	●	● (compressed)	●	●	●	●
Runs from batch file	●	●	●	●	●	●	●	●
Performs automatic backups	○	●	○	●	○	○	●	○
Saves include files	●	●	● (catalog)	●	○	●	●	●
Saves exclude files	●	●	○	●	○	●	●	●
Saves command files	○	●	●	○	○	●	●	●
Prevents file overwriting	● (not read-only file)	●	● (not read-only file)	●	●	●	●	●
Sets archive bit	Optional	●	Optional	●	Optional	●	●	●
Verifies backup	Optional	●	Optional	●	Optional	●	●	●
Estimates number of disks	●	●	●	●	●	○	●	●
Creates catalog on target device	○	●	○	●	●	●	●	●
Displays disk number	●	●	●	●	●	●	●	●
RESTORE FEATURES								
Verifies restore	○	●	●	●	○	●	○	○
Restores to different directory	○	●	●	●	○	○	●	○
Restores to different device	●	●	●	●	○	●	●	●
Creates restore report	● (on-screen only)	●	● (on-screen only)	●	○	●	○	●
Searches through catalog	● (lists files on-disk)	●	● (lists files on-disk)	●	●	●	○	○
BACKUP TYPES								
Full backup	●	●	●	●	●	●	●	●
Backup by archive bit	●	●	●	●	●	●	●	●
Backup by directory	●	●	●	●	●	●	●	●
Backup by date	●	○	●	●	○	○	●	●
Backup by date range	●	○	●	○	○	○	●	●
Backup by wildcard	●	●	●	●	○	●	●	●
Backup by filename	●	●	●	●	●	●	●	●
OTHER								
Other utilities	None	DOS shell, full file manager	DOS shell, file and directory maintenance	File maintenance volume utilities	None	None	DOS shell, macro utilities	DOS shell, tree utilities

be any size you want—leaving anywhere from 128K to 640K for DOS and application programs. RAMdisk parameters can be set from the keyboard without setting any internal board switches. And one of *JetDrive*'s nicer features is that the RAMdisks will survive a warm boot.

Because *JetDrive* was not intended as strictly a backup program, it is different from most of the other packages on the market. Its features are file transfer features. But despite its inability to back up multiple subdirectories in one command and its relatively slow backup and restore speeds, the program has a lot of backup flexibility and power. With its additional RAMdisk capabilities the package is a good investment for only $60.
—Henry Fersko-Weiss

PC-FullBak

"Lean and mean" is what *PC-FullBak* is all about—and it is surprisingly mean for an application so lean. The program's menus do not bulge with options and features. The documentation is positively emaciated. But it gets the job done extremely quickly, without a lot of fuss. Perhaps best of all, the price of Westlake Data's program, $59.95, is lean indeed for software that works so well.

PC-FullBak's on-screen presentation is sparse compared with that of other programs. An empty screen is topped with a menu line that offers you only seven choices—and one of those is Quit. The others are Backup, Compare, Restore, Modify, List, and Append. No file maintenance, no diskette utilities. When a backup is started, the screen shows the parameters in effect for the operation, the name of the file being operated on, and two time clocks—the elapsed time since the backup started and the amount of time *PC-FullBak* has spent waiting for its user to supply it with diskettes.

"Lean" means there are things *PC-FullBak* doesn't do: it doesn't create and save directories of backed-up files (it will scan a backup disk and list the files it finds). It doesn't do a backup from user-generated lists of files. It doesn't do read-after-write verifications, but asks (almost *demands*) that the user do a comparison of the backup and the original files. It uses a proprietary disk format but won't even format a disk except as it is used in a backup—which can make the first backup with a new set of diskettes a very slow process.

But after that first time, it flies. The program's backups and restores in the Bigfile test were among the fastest of the programs tested.

It's tough to beat, and it's tough to break: *PC-FullBak* handles errors exceptionally well. A drive door opened during a format operation merely registers as a disk error, and the track is locked out. If it happens during a backup, the program simply waits for the door to be closed and goes on without missing a beat. It rejects damaged diskettes from backups and gives ample notice of disk errors during compares and restores.

PC-FullBak wouldn't handle the Scatter environment—which is not surprising. But unfortunately it broke without an error message: it very quietly failed to back up about 2.5MB of the directories and files, which is not good at all, and counter to the program's otherwise excellent error handling.

PC-FullBak is tough, but it goes easy on the user. It doesn't force the user to configure the program to the machine it's running on—*PC-FullBak* is smart enough to do the job itself. It is easily set up, can be run from the DOS command line, and will append backup files to a partially filled disk. This makes it easy to do what for users is the toughest job of all—to slip in a disk, run a little batch file, and actually back up those new and modified files regularly, daily. No pain—but big gain.
—David DeJean

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

PC-FullBak
Westlake Data
P.O. Box 1711
Austin, TX 78767
(512) 328-1041
List Price: $59.95 (5¼-inch disk); $69.95 (3½-inch disk)

Requires: 256K RAM, one floppy disk drive, a hard disk, DOS 2.0 or later.

In Short: *PC-FullBak* isn't long on bells and whistles, but it has what it needs to do most backup jobs efficiently and very quickly. Its ease of use and low price make it an especially good value. Not copy protected.

CIRCLE 655 ON READER SERVICE CARD

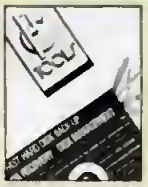
PC Tools Deluxe

PC Tools Deluxe, from Central Point Software, is the clear winner of the Ginsu Knife Memorial Trophy: it offers file-by-file backup and restore operations. But that's not all! You'll un-fragment large files with the disk optimizing utility. Speed up big programs with the caching software. Recover from disasters with utilities that back up the hard disk's file allocation table and track file deletions. Want more? The clincher (the DOS equivalent of a set of steak knives) is a useful set of file-management tools (including a better-than-rudimentary text editor) that can run as a RAM-resident utility.

Poetic justice almost demands that the $79 program's backup functions be lousy. But aside from a few limitations, the backup is fast, the program is flexible, and the interface is very clean, quick, and painless—it makes it easy to do things right and difficult to make time-wasting mistakes.

Backups can be run either from within *PC Tools Deluxe* or from the DOS command line. Operation within the program is efficient: a minimal number of keystrokes can start a backup. When run from

PC MAGAZINE FACT FILE



PC Tools Deluxe
Central Point
Software Inc.
9700 SW Capitol Hwy.,
#100
Portland, OR 97219
(503) 244-5782
List Price: $79

Requires: 256K RAM, one floppy disk drive, a mass storage device, and DOS 2.0 or later.

In Short: A clear user interface makes *PC Tools*' backup easy to use. Its ability to work from lists makes it powerful, and other functions make it a great bargain. Not copy protected.

CIRCLE 654 ON READER SERVICE CARD

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Distribution through Kenfil, MICRO D, Gates, GBC Distributors, TRICOM and Vitronix. In Canada, contact Pride Computer Dist.

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CIRCLE 225 ON READER SERVICE CARD

the command line, *PC Tools* can take its instructions from a "response file," a text file that specifies any number of subdirectories and file specifications, including wildcard selectors.

The program uses a proprietary disk format but saves a DOS-format log of the files backed up. This log is a help and a hindrance. If there is an existing log file and only a few subdirectories are selected for backup, the program assumes any backup should be treated as an "append" to that existing file and the backup disks it covers. This makes incremental backups very easy, but it makes starting a new backup difficult. The program won't accept a new floppy disk until the user has removed or renamed the log.

PC Tools' backup functions lack features found in the more-powerful applications dedicated entirely to backup. While it will write to any floppy disk format, it writes only to floppies—not to tape backup units or network servers. There is no "read after write" verify mode: to verify the accuracy of a backup, the user has to feed all the disks back through the computer to be compared against the original files. There's no tree diagram of the directory structure to help users select subdirectories for backup, nor does the program indicate how many disks a backup is likely to require. (Because the program formats floppy disks as it writes to them, this last is the most minor of nuisances.)

Virtually all of *PC Tools*' other capabilities are available as pieces of utility packages, ranging from *The Norton Utilities* to *SideKick*. Yet there is no feeling that the package has been thrown together; careful design is evident. The same keys do the same things across *PC Tools*' functions. The program installs itself, but what it does is clearly prompted for, and can be easily undone. The installation procedure writes to the user's AUTOEXEC.BAT file, but does it very intelligently.

Even with their limitations, *PC Tools*' backup and restore capabilities are fully the equal of backup applications costing more. Finding them bundled with so many other useful utilities makes the bargain almost irresistible.—**David DeJean**

PC Tools Deluxe
makes it easy to do things right and difficult to make time-wasting mistakes.

Pdisk

Productive, perspicacious, persistent—that's *Pdisk* from Phoenix Technologies. A paragon of versatility, this $195 set of directory-oriented file utilities is linked by a menu-driven control program. You can use the utilities—backup, restore, move, park, and cache and cache control, as well as tree copy, directory, compare, delete, and remove directory—from the menu or from a command line at the DOS prompt.

Pdisk can also be pesky and overprotective. It belongs to the group of backup programs that demand you press Enter every time you've inserted a new floppy into the destination drive.

But that's our only complaint (petulant, we admit), other than the screen display and menu bar, which could use some revamping. Sleek they are, but we've come to prefer a little more detail. To *Pdisk*'s credit, pressing F1 elicits help, and choosing the Verbose option fills the bottom of the screen with pertinent backup information.

Pdisk can be proud of its impressive list of features. It tells you how many files you will be backing up and how many disks you will need, lets you include and exclude files and directories, skips empty directories, detects used and defective disks, warns you about file errors, and formats disks automatically. It also gives you a way to set your own options and parameters, saving you from having to type them in each time. Anyone can do it; the manual clearly explains how.

Other *Pdisk* pluses are a full list of incremental backup options, support for wildcards, and complete error messages as well as directions for how to correct the errors. The handy Move utility lets you move, not just copy, programs and directories. If you must move your PC and don't want to damage your disk or the data on it, you'll appreciate *Pdisk*'s Park utility. The Cache utility improves your hard disk's performance. With the five Tree utilities, you can manage the directories on your hard disk—that's real added value.

Pdisk is a powerful performer. It's packed full of features, and it's fast. Notwithstanding how peeving it can be to press Enter each time you insert a new disk, *Pdisk*, no phony, has reason to be proud.—**Carol Olsen Day**

FACT FILE

***Pdisk*, Version t.02.40**
Phoenix Technologies Ltd.
320 Norwood Park So.
Norwood, MA 02062
(617) 769-8310
List Price: $195
Requires: 256K RAM, IBM PC/XT/AT or compatible, DOS 2.0 or later
In Short: Packed full of features, this backup program is really a set of directory-oriented file utilities joined by a menu system: backup, restore, move, park, and cache and cache control, as well as tree copy, directory, compare, delete, and remove directory; you can also bypass the menus and access the utilities from a DOS command line. Versatile and powerful *Pdisk* clearly is, but with one minor flaw: it insists that you press Enter after you insert each disk. Not copy protected.

CIRCLE 653 ON READER SERVICE CARD

Quiksave

Ask Micro Interfaces' *Quiksave* to back up a hard disk with a hierarchy of many subdirectories, each with a few files in it, and you'd better have a lot of disks on hand. The $99 program is quick to gobble up magnetic media in that situation, but slow to finish its meal.

Quiksave's insatiable appetite is fed by its need to write the directory on each backup disk. But since most people don't have hard disks with 2,000 subdirectories of a few files each, writing the directory on each disk is not a problem outside of a testing environment. In fact, in the real world of backups, it can be a good thing, enabling *Quiksave* to come up with a directo-

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Network Solutions. Backup a server across your network to either a diskette, tape or hard disk. Be secure that CORE backup systems support major LAN networks including Novell, 3Com and IBM Token Ring.

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Distribution through Kenfil, MICRO D, Gates, GBC Distributors, TRICOM and Vitronix. In Canada, contact Pride Computer Dist.

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CIRCLE 224 ON READER SERVICE CARD

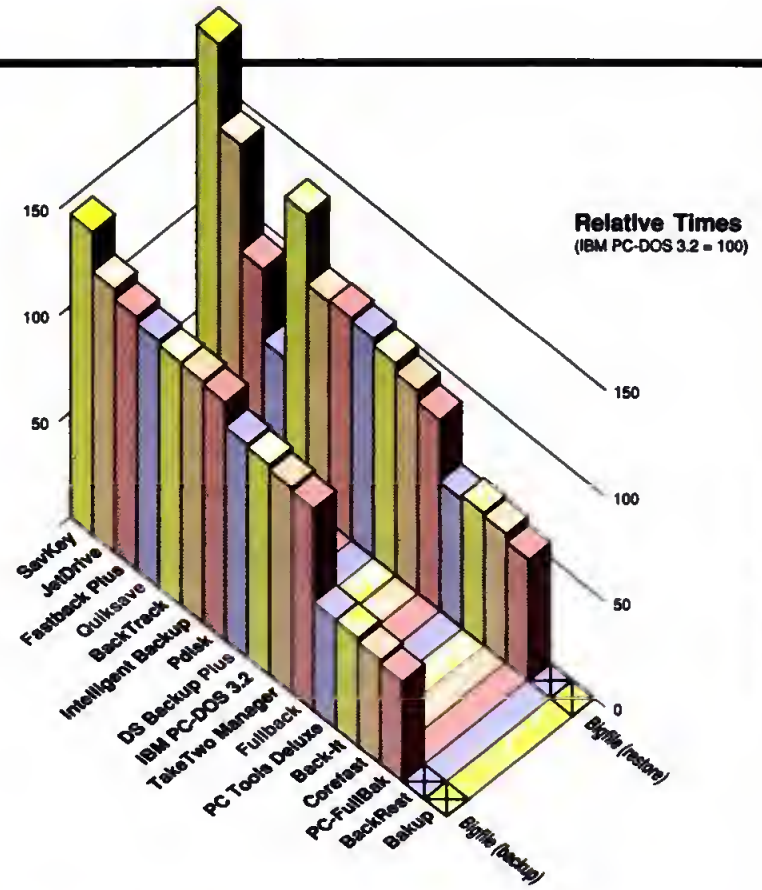
Performance Tests: Backup Software

PC Labs compared the test results for 16 software backup packages with the performance of the IBM PC-DOS 3.2 programs, BACKUP.COM and RESTORE.COM. Out of all the packages tested, only *Bakup* and *BackRest* could not perform the backup or restore for Bigfile; they couldn't handle a single file of that size. (Scatter test results are not shown since only *Fastback Plus*, *Corefast*, and *PC Tools Deluxe* were able to complete the test besides IBM PC-DOS.) *PC-FullBak*, *Corefast*, and *Back-It* were Bigfile's three front-runners, coming in almost twice as fast as BACKUP.COM and RESTORE.COM. The menu-driven *PC-FullBak* offered very clear instructions; also easy was *Corefast*, requiring no real configuration. Conversely, *Back-It* proved difficult both to configure and to run.

The middle-of-the-road programs were *Fullback*, *TakeTwo Manager*, and *DS Backup Plus*, ranking closely with the IBM backup and restore programs; *DS Backup Plus*, however, does offer a turbo mode to back up and restore. And while *Fastback Plus* did not stand up well against its competition, it should be noted that the program is indeed a very powerful backup and restore program with the flexibility to perform data compression during a standard backup and restore cycle. Its restore cycle was much faster than its backup cycle.

The **Bigfile** performance test is a program designed to measure the ability of backup software to back up and restore a large, contiguous file with no DOS or system overhead to affect the timing results. To accomplish this end, the program generates and uses a 10,000,000-byte file consisting of random text.

Results reflect the amount of time necessary to swap the diskettes in and out of the drive. They also reflect the time it took from the last keystroke to start the backup or restore procedure until the last diskette was used and keyboard control returned to the user.

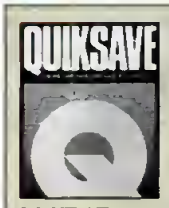


Performance Times
(Times given in seconds)

	Bigfile (backup)	Bigfile (restore)
SavKey	862	871
JetDrive	750	685
Fastback Plus	721	448
Quiksave	701	286
BackTrack	689	647
Intelligent Backup	686	492
Pdisk	678	495
DS Backup Plus	610	487
IBM PC-DOS 3.2	602	472
TakeTwo Manager	587	451
Fullback	577	426
PC Tools Deluxe	311	289
Back-It	308	297
Corefast	296	290
PC-FullBak	283	271
BackRest	N/A*	N/A*
Bakup	N/A†	N/A†

N/A*—Not applicable: took over 10 minutes per floppy disk.
N/A†—Not applicable: failed test.

FACT FILE



***Quiksave*, Version 2.20**
Micro Interfaces Corp.
16359 NW 57 Ave.
Hialeah, FL 33014
(305) 623-9292
List Price: $99
Requires: 256K RAM, hard disk drive, IBM PC/XT/AT or compatible, DOS 2.0 or later.

In Short: If you're forgetful about backing up your files, you'll appreciate *Quiksave*'s user-established warning schedule and its up to nine preset configurations; but don't try using it to back up hundreds of subdirectories with a few files in each (more likely in a test than in the real world) unless you have stacks and stacks of disks on hand. Otherwise, its menus and screens offer all the options you'd expect of a fast backup program. Not copy protected.

CIRCLE 652 ON READER SERVICE CARD

ry quickly and accurately when you ask it to do a selective restore.

You ask *Quiksave* to back up, restore, or verify by selecting those options from the main menu. Pressing function keys effects certain operations, but F1 is not help. The only on-line help available appears on-screen unsolicited in the form of menus, options, or prompts, or in a help window. The program's screens are somewhat cluttered, but they're effective.

Quiksave cares. To help make sure you back up your files, it will remind you and up to eight other users when you've gone too long without asking it to handle your backup chores. You use the Configuration Screen to tell it how often to warn you; you can opt to get a warning about certain files every ten days, say, and other files every two days.

You can also specify other configuration details like which drives and directories to use, whether to back up subdirectories, which if any system files to exclude, whether to print out a report, and so forth. *Quiksave* lets you create up to nine different backup configurations and store them under unique identifiers. Choosing a preset configuration saves time over specifying details each time you back up, restore, or verify information.

Quiksave offers other advanced features typical of high-performance backup programs, including complete status reports, the ability to choose which files to back up by highlighting them on-screen, estimates of the time and disks needed, automatic formatting, error correction, selective file inclusion or exclusion, and data verification. Installing the program is easy, but using the automatic install program will create and/or modify your AUTOEXEC.BAT and CONFIG.SYS files.

The DiskChek feature will run DOS's CHKDSK to check for hard disk errors each time you boot up your system. It will also warn you if a floppy you're using is defective and give you time to replace it without stopping the backup. When you do a selective restore and verify, you can ask *Quiksave* to sort files alphabetically by extension or by name. You can also ask the program to search for specific files. *Quiksave* will accept wildcards, and, it's a fast worker. You can even bypass the menus and configuration screens by choosing to back up from the DOS command line. A new release with the significant improvement of allowing you to back up over several disks will be available by the time you read this review.

Quiksave has its quirks, but it's capable. Better yet, it tries to make the backup process easier and safer for you by accepting your preset configurations, alerting you to errors, and warning you when too much time has elapsed since your last backup. A nag it may be, but that's a good thing in a backup program.

—Carol Olsen Day

SavKey

SavKey, from Business-Pro, is basically a front end to the DOS BACKUP and RESTORE commands; as such, it has the same limitations as those commands. But what Business-Pro has done is automated the processing of backup and restore and dressed it up in menu-driven screens. In addition, the $89.95 program gives you the ability to back up only those files that have changed, and it issues a daily reminder to back up your system.

SavKey comes with a special installation disk, so installing the program is simple. As part of the installation, your current

"YOU HAVE A TREAT COMING" That's what *PC Magazine* had to say about PC-File+, and now this powerful database program is even better: **NEW!** Graphs to help you make your point. Includas: pia, bar, lina, scattar, and smoothed avarage. **NEW!** 8087/80287 math coprocessor support for lightning fast operation. **NEW!** Expanded record and field lengths hold more data.

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CIRCLE 511 ON READER SERVICE CARD

ERASE. ARE YOU SURE?

Every computer user faces this question in some form each day. To erase or not to erase. To save or not to save, when saving means overwriting the previous version of a file. If you answer yes and you're wrong, *countless hours of work will be wiped out by a single keystroke!* And there won't be anything you can do about it, unless you're backed up.

Disk failure, theft, power surges—any of these can sneak up on you when you least expect it. However you look at it, backing up important files is essential. And nothing will make a believer out of you like finding out, just once, that you weren't as sure as you thought.

MaynStream: A Sure Thing.

MaynStream is a file-by-file backup system that protects information on your drive by copying it onto a special tape and restoring it from the tape to any drive you specify, on command. With MaynStream, backup is a breeze. You'll see all the options you need right on the screen. In seconds, you can easily customize the backup process to work the way that's best for you.

Backup Is Just The Beginning.

MaynStream's pull-down menus make it remarkably easy to back up, restore, assign names to frequently backed-up groups of files, select optional password protection, and more! And context-sensitive, on-screen help is just a keystroke away.

And, because MaynStream is completely portable and compatible with all PC and PS/2 systems, you can use a single MaynStream to back up all the personal computers in your office—whether you have a classic PC or compatible, or a PS/2 Model 30, 50, 60, or 80! Plus, MaynStream is Novell-approved, and works with all popular LANs including Novell, 3COM, and IBM's PC Net.*

The Inside Track

MaynStream is also offered for internal installation in the PC or compatible, and in the PS/2 Models 60 and 80. Plus, it comes with a number of faceplates designed to match today's most popular computers.

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CIRCLE 495 ON READER SERVICE CARD

PC MAGAZINE FACT FILE

***SavKey*, Version 3.03**
Business-Pro
P.O. Box 44075
Phoenix, AZ 85064
(602) 996-6547
List Price: $89.95
Requires: 128K RAM, DOS 2.0 or later.

In Short: *SavKey* is basically a front end to the DOS backup and restore commands. What it provides is automation and menu-driven screens to carry out these functions. The program is easy to use and install, but it has several weaknesses. It is slow, cannot handle deep layers of subdirectories, and is difficult to use for backing up a single specified file. Not copy protected.

CIRCLE 651 ON READER SERVICE CARD

AUTOEXEC.BAT file will be renamed, and a new AUTOEXEC.BAT will be substituted. This new file will automatically bring you to the *SavKey* title screen when the system is rebooted, and you press any key at the date prompt. You can also manually install the program and just add the appropriate path command to your AUTOEXEC.BAT file so the program will run but won't automatically load when you reboot.

At the end of the installation, an analysis screen shows you how much space is needed to do a full or daily backup and how many 360K or 1.2MB disks it would take to do both types of backup.

Before using *SavKey*, you may want to customize it a bit. You can change the colors used in the menus and messages; change some printer parameters such as port designation, page length, and left margin; and alter system parameters like the starting directory, target disk drive, and exit key.

SavKey offers you three basic types of backup: daily, partial, and full. A "daily" backup procedure will copy all the files that have changed since the last backup you performed—whether it is full or partial. It doesn't matter how long ago the last backup was done, so the word *daily* here is just a figure of speech or a moral recommendation. A partial backup will copy all the files that have been changed since the last full backup, no matter how long ago it occurred. And naturally, a full backup will copy all of a system's files.

The program forces you to do a partial backup after a certain number of daily backups; a full backup is required after a set number of partial backups.

There are three other operational choices on the main menu. Report will bring up a screen showing the last ten backups you performed. The report tells you the type of backup, date, and time. Unfortunately, the report can be output only to a printer. The Format choice will let you format blank disks. The End-of-Day selection will allow you to park the head of your hard disk if you selected this feature when you customized the program. But only the factory-supplied 10MB hard disk of the IBM PC-XT is supported by this parameter.

***SavKey* offers you three basic types of backup: daily, partial, and full.**

There are several weaknesses in *SavKey*. One of them is the speed of operation. Backing up a 10-million-character file took over 14 minutes—the longest time of the six programs I reviewed and one of the longest for all the programs in this roundup. When trying to back up a system with over 1,500 directories nested very deeply, the backup procedure was slowed to a crawl of 6 minutes per floppy.

AS RECENTLY AS YESTERDAY, A TRULY SOPHISTICATED ANSWERING SYSTEM SOLD FOR $20,000.

However, it was one of only two programs that could accomplish this backup at all. The program has no easy way to back up a single specified file. And lastly, if a backup procedure is aborted in the middle, the system doesn't recognize that the backup is incomplete. You are given a message that the backup is complete, not that it was aborted.

SavKey furnishes a menu-driven front end to the DOS BACKUP and RESTORE commands. It makes working with these commands easy and automatic. But its weaknesses must be carefully considered.—**Henry Fersko-Weiss**

TakeTwo
TakeTwo Manager

TakeTwo Manager, from United Software Security, is similar to a camera that lets you point and shoot without worrying about more than focusing and having film in the camera—but also lets you manually adjust the aperture and the shutter speed when you need to.

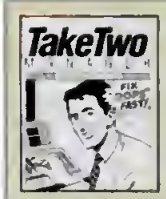
TakeTwo Manager ($139) also has both automatic and manual modes. In automatic, you simply pick the right media; in manual, you can choose the directories and files you want to back up and even indicate how frequently it should be done. This excellent operating flexibility is enhanced by the program's abundant backup and restore information: a detailing of the backup process by units, percentage, and even speed in kilobytes per minute—and also historical reports that show the backups by date as well as on which disks the files are located.

After *TakeTwo* is installed, you can run the program from the hard disk root directory by typing "TT". Up comes the Backup Status Display screen with notice of how many directories, files, and bytes will be backed up. When a backup is in progress, the top of the screen also gives you a continuous update in units and percentages. Directory and filenames appear as they are being backed up. Below them on the screen are shaded columns of space that fill up with the numbers of the backup floppies. Each number label changes color like a bar chart as the diskette is filled with information.

If you run *TakeTwo* on manual, you can be very selective about what you want backed up and how often. Your main menu choices are Backup, Restore, System Configuration, File Configuration, History, Print Reports, and Quit. You can specify the backup class of each directory and file on the File Configuration screen; the classes are Regular, Once, or Never. Regular backups occur whenever a file is changed, or can be set to a frequency of 1 to 60 days. You can go directly to the File Configuration screen from DOS by typing "TT/F".

Throughout the program, you have a choice between key commands or menu selections. In the file configuration process, for example, you can call up a list of

FACT FILE



***TakeTwo*, Version t.2**
***TakeTwo Manager*, Version 2.02**
United Software Security Inc.
Vienna, VA 22180
(703) 556-0007
List Price: *TakeTwo*, $99; *TakeTwo Manager*, $139.
Requires: 256K RAM, DOS 2.1 or later.
In Short: *TakeTwo* is an excellent backup program that can be operated in automatic or manual mode. In manual, you can back up entire systems or individual files on a regular or one-time basis; you can also specify the frequency of regular backups. The restore features are even more powerful, letting you restore old backup versions of your system or individual files. A file manager, report generator, and historical record round out *TakeTwo Manager*. Not copy protected.

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It's called The Complete Answering Machine. And it is the most sophisticated, affordable voice mail system you can buy.

files in a directory by hitting F7 and typing the directory name or by pressing U for up, D for down, N for next, or P for previous. Menu choices can be made by typing the first letter or using the arrow keys followed by Enter.

TakeTwo's restore function is particularly powerful. You can restore an entire hard disk, groups of directories, and files (by using tags or wildcards) or a single file. The Restore screen tells you if a file has subsequently been deleted from the hard disk, or if there is an older backup. If you are backing up just one file, *TakeTwo* will tell you exactly which backup disk to load. Older backups of a file can be picked from a pop-up screen that tells you the time and date the file was created or modified, its byte size, and time and date of each backup. Any of the old file backups can be deleted while they are at this screen.

And the program maintains a full historical record of your backups on the History screen. Each backup is listed in reverse date order, followed by the time of backup, type, number of directories, files, and bytes. By pressing F5, you can see specific file-by-file information about each backup. *TakeTwo Manager* lets you print reports on individual backups and restores, history, file configuration, and system configuration.

TakeTwo Manager also comes with a file-management utility that can be made resident. It gives you a tree-structured view of your system with appropriate file information and enables you to perform such basic management operations as rename, copy, find, print, and undelete.

The combination of backup program and file management in *TakeTwo Manager* is a bargain in itself for $139. But United Software also sells the backup program alone under the old name of *TakeTwo* (upgraded, of course) for only $99. In either version, it's an excellent choice for backup.

—Henry Fersko-Weiss

PC MAGAZINE EDITOR'S CHOICE

- **Corefast**
- **PC-FullBak**

Backup is an annoyance at best. If the software makes it even more annoying, then backups stop getting done. So the user interface becomes one of the most important aspects of backup software.

Corefast *has that necessary ease of use—a well-organized, understandable, menu-driven interface—matched with a most impressive set of functions. No backup job is too tough for* Corefast. *While other backup programs are picky about what jobs they'll do,* Corefast *simply does them all. And its user interface shines in one additional area as well—excellent documentation.*

Corefast *has been an Editor's Choice before, in our April 28, 1987, review of backup software. It is an Editor's Choice again.*

PC-FullBak *has not been reviewed before, but this first-timer quickly rose to the top of the heap in testing. Though not as fully featured as* Corefast, PC-FullBak *brings to a limited task—backing up from a hard disk to floppies—many of the same strengths as the larger program.* PC-FullBak*'s screens are clear and crisp; its operation is fast and easy. And its ease of use inspires use—which is what backup is all about.*

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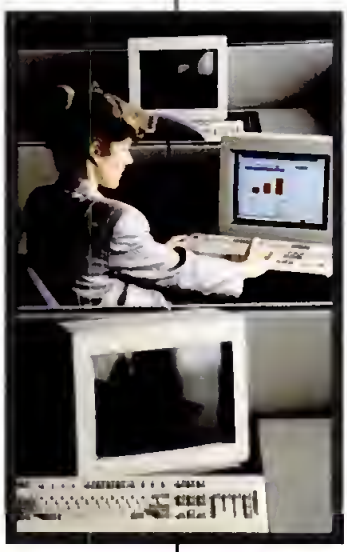
–Al Poor, Editor's Choice, PC Magazine



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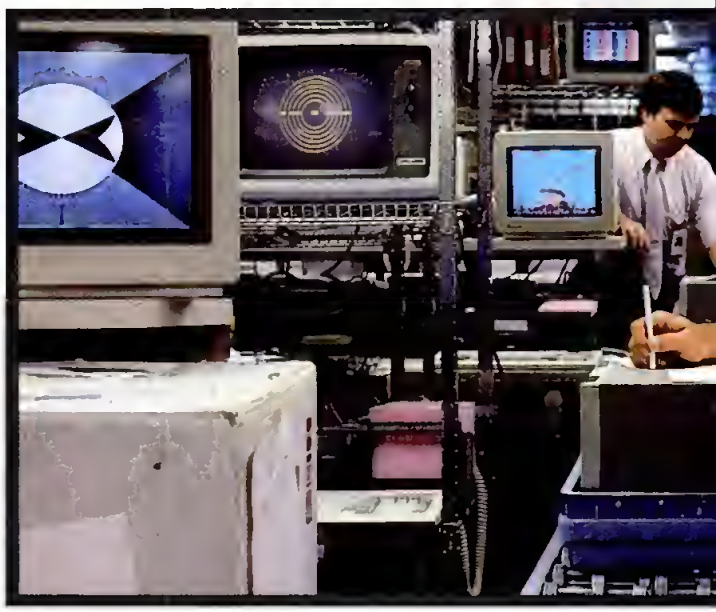

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–Stanley W. Angrist, Forbes

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Standard Features:

- Intel† 80386 microprocessor running at 20 MHz.
- 1 MB of 80 ns 32-bit RAM expandable to 16 MB without using an expansion slot.
- Advanced Intel 82385 Cache Memory Controller with 32 KB of high speed static RAM.
- Socket for 20 MHz 80387 coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- Dual diskette and hard disk drive controller.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports.
- 200-watt power supply.
- Real-time clock.
- 8 expansion slots (6 available with hard disk drive controller and video adapter installed).
- Dell System Analyzer.
- MS-DOS and MS OS/2 compatible.
- Security lock with locking chassis.
- 12 month on-site service contract (Available on complete systems).

Options:

- 1 MB RAM upgrade kit.
- 20 MHz Intel 80387 math coprocessor.
- 2 MB or 8 MB memory expansion boards.

SYSTEM 310	With Monitor and Adapter		
Hard Disk Drives	VGA Mono	VGA Color	VGA Color Plus
40 MB-28 ms	$3,799	$3,999	$4,099
90 MB-18 ms ESDI	$4,599	$4,799	$4,899
150 MB-18 ms ESDI	$5,099	$5,299	$5,399
322 MB-18 ms ESDI	$7,099	$7,299	$7,399

THE NEW SYSTEM 220.

As fast as most 386 computers, at less than half the price—more power for the money than any other system. An 80286 system that runs at 20 MHz, with less than one wait state. Completely compatible for both MS-DOS and MS OS/2 applications (it runs OS/2 faster than IBM PS/2 Model 80), and with a remarkably small footprint, the System 220 is the ideal executive workstation for database management, business, or sophisticated connectivity applications. The system uses page-mode interleaved memory; the page-mode RAM operates at less than one wait state, and inter-leaving results in a performance increase of about 15 percent.

Standard Features:

- 80286 microprocessor running at 20 MHz.
- 1 MB of RAM expandable to 16 MB (8 MB on system board).
- Integrated diskette and VGA video controller on system board.
- One 3.5" 1.44 MB diskette drive.
- Integrated high performance hard disk interface on system board.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports.
- LIM 4.0 support for memory over 1 MB.
- Real-time clock.
- Three full-sized AT† compatible expansion slots.
- Socket for 80287 coprocessor.
- Dell System Analyzer.
- MS-DOS and MS OS/2 compatible.
- Security lock with locking chassis.
- 12 month on-site service contract (Available on complete systems).

Options:

- 3.5" 1.44 MB diskette drive.
- Intel 80287 coprocessor.
- 1 MB RAM upgrade kits.

SYSTEM 220	With Monitor		
	VGA Mono	VGA Color	VGA Color Plus
One Diskette Drive	$1,799	$1,999	$2,099
40 MB-29 ms Hard Disk	$2,499	$2,699	$2,799
100 MB-29 ms Hard Disk	$3,399	$3,599	$3,699

THE NEW SYSTEM 200.

A great value in a full-featured AT compatible. An 80286 computer running at 12.5 MHz, this system is completely MS OS/2 compatible. It's ideal for general business applications, as well as software development, local area networks, CAD/CAM, and desktop publishing. The System 200 offers high speed drive options, industry standard compatible BIOS, and on-site service. At these low prices, the System 200 is the best value in the 80286 marketplace. As Executive Computing said of this computer's predecessor, "If faster processing speed and low cost are two key issues affecting your purchase decision, this machine might be the ideal choice for your office."

Standard Features:

Intel 80286 microprocessor running at 12.5 MHz.
640 KB of RAM, expandable to 16 MB (4.6 MB on system board.)
5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
Dual diskette and hard disk drive controller.
Enhanced 101-key keyboard.
1 parallel and 2 serial ports.
200-watt power supply.
Real-time clock.
6 expansion slots. (4 available with hard disk drive controller and video adapter installed).
Socket for 8 MHz 80287 coprocessor.
Dell System Analyzer.
MS-DOS & MS OS/2 compatible.
Security lock with locking chassis.
12-month on-site service contract (Available on complete systems).

Options:
512 KB RAM upgrade kit.
8 MHz Intel 80287 coprocessor.

SYSTEM 200	With Monitor and Adapter			
Hard Disk Drives	Mono	VGA Mono	VGA Color	VGA Color Plus
20 MB	$1,799	$1,999	$2,199	$2,299
40 MB-40 ms	$1,999	$2,199	$2,399	$2,499
40 MB-28 ms	$2,199	$2,399	$2,599	$2,699
90 MB-18 ms ESDI	$2,999	$3,199	$3,399	$3,499
150 MB 18 ms ESDI	$3,499	$3,699	$3,899	$3,999
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A full-featured, yet economical one-piece computer for office, school, or home. This system is fast, easy to use, and ready to run with Dell Enhanced MS-DOS 3.3, Microsoft† DOS Manager, and Microsoft Works software—more than a $400 value, included at no extra charge. Complete MS-DOS compatibility means you can run thousands of programs for business, personal finance, education, and entertainment. And the System 100 can grow, with the high quality options listed below. A price leader in 8088 technology, the System 100 boasts an innovative design that allows for more power, speed and convenience than most of its competitors.

Standard Features:

Intel 8088 microprocessor running at 9.54 MHz selectable to 4.77.
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Diskette drive controller integrated on system board.
Integrated high-quality 84-key keyboard.
1 serial and 1 parallel port.
Two full-sized expansion slots available when video adapter is installed.
One half-sized expansion slot used for video adapter.
Socket for 8 MHz 8087 coprocessor.
Internal speaker with earphone jack and volume control.
Security Tie-Down bracket.
Dell Enhanced MS-DOS 3.3 Microsoft DOS Manager, Microsoft Works.

Options:
3.5" 720 KB diskette drive.
8 MHz Intel 8087.

SYSTEM 100	With Monitor and Adapter			
	Monochrome	CGA Color	VGA Mono	VGA Color
720 KB Diskette Drive	$799	$899	$999	$1,199
Two 720 KB Diskette Drives	$949	$1,049	$1,149	$1,349
20 MB Hard Disk	$1,299	$1,399	$1,499	$1,699

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1.5 MB standard memory, expandable to 2.0 MB

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1.5 MB standard memory, expandable to 2.0 MB

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Printer System 600 $499.95
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Near-letter quality at 60 cps
Standard parallel interface
12.6 KB Buffer (expandable to 28.6 KB)
Wide carriage

Printer System 300 $199.95
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Draft quality at 144 cps
Near-letter quality at 36 cps
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Paper parking
4 KB buffer
Standard Parallel interface

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COVER STORY ▼ WINN L. ROSCH

HARDWARE STANDBYS: PS/2 TAPE DRIVES

Tape backup systems designed for the PS/2 line tap into IBM's high-speed Micro Channel architecture for the fastest, most efficient backup available on magnetic media.

USING A TAPE BACKUP SYSTEM IS like plunging headfirst into an icy pool—it helps you get the worst over with fast. Nothing will turn the time-consuming routine of backing up into a pleasure. The best you can hope for is to minimize the pain, substituting shock therapy for the dawdling that stretches the discomfort into torture.

The good news is that the Micro Channel architecture of IBM's high-end PS/2s will help you make tape backups faster than ever before. Finally, personal computers can supply data to disk drives as fast as the drives can absorb it. Though hardly eliminated, the waiting game is less of a pain when the hard disk you need to back up is plugged into a PS/2.

Gone, for instance, is the nagging problem of underrun—the tape stopping, then backing up to find where the data ran out, then starting again. With the Micro Channel, high-speed interfaces, and DC600-style tape drives, data streams to tape as fast as it can be written—at 90 inches per second, or about 5MB per minute. Even floppy-disk-interfaced systems, such as those based on the QIC-40 standard, stream continuously at the speed limit of the interface—50 inches, or 500 kilobits per second.

Besides speed, these PS/2 tape systems boast other improvements. Longer tapes and more heads inside DC600-style cartridge tape drives have increased media capacity significantly. While 60MB was the maximum just 2 years ago, today you can buy drives that squeeze up to 250MB onto a single tape—for instance, in Core International's CT250.

The cassette drive is coming into its own, too. One cassette tape now can hold 60MB and accept data at the DC600 rate. The cassettes themselves are familiar, compact, easy to use—and incompatible with ordinary audio tapes, which they resemble. They connect to the same interfaces and operate with the same software that powers more-traditional media. The only doubts that linger about cassettes concern data integrity—the thinner tape and the less robust shell hint at possible dangers—although short-term testing in PC Labs has revealed no errors in data restoration.

Of all the PS/2 tape backup systems available, the price leaders remain the systems based on DC2000-style cartridges. Because most of these systems just slide into a floppy disk slot and require no extra interface, case, or power supply, you get a high-speed backup system at relatively low cost.

What you lose is responsiveness. Instead of the near-instant reactions of the DC600-style and cassette-based systems, the DC2000-style backups spend a good deal of their time housekeeping—indexing, reading directories, and so on—before they get on with their work. If you're used to pressing a button and getting results, these drives will prove less than satisfying.

They also run more slowly, at about a 2-minute-per-megabyte throughput rate. The latest generation in floppy disk backup systems can equal (and sometimes better) that rate because both types use the same interface, and the floppy disk systems require less time for calibration.

Today's tape backup systems make the time devoted to backing up almost a moot issue because they also allow you to automate your backups. While just 2 years ago the idea of your tape system automatically backing up your hard disk system while you sawed your way through the night was far-fetched, today every one of these systems makes some provision for unattended backups—some more successfully than others, some only optionally.

Give a command and walk away; the tape system does the rest. You don't have to care how long it takes because you don't have to sit around pressing buttons and watching the tape stream by.

Many of these systems wait patiently in the background, springing to life only at the appointed backup time. You can load such software through your system's AUTOEXEC.BAT file and never give it a second thought—except to change tapes as necessary.

CHOOSING A SYSTEM To find the right tape backup system, you have to consider both hardware and software. The primary hardware-based decision is between external and internal units. Internal drives may be somewhat easier to install but, because all are based on DC2000-style cartridges and the QIC-40 standard (or something close to it), they are slower. External drives require additional installation steps and tend to be more costly, but they are also faster and can be shared by several systems.

Software determines not only backup speed but also how easy the various systems are to work with. Most of these systems offer both menu- and command-driven modes. You can probably start using a menu-driven program even before you've read the manual. A command-driven mode will allow you to build elaborate batch files to customize and automate your everyday backup chores.

Many of these tape systems give you the choice of file-by-file or image backups. *File-by-file* backups read each disk file individually and store each file as a discrete unit on the tape. *Image* backups copy all data on a disk regardless of file structure. While image backups are often faster

IMAGE VS. FILE-BY-FILE: TWO PATHS TO TAPE BACKUP

Most tape backup systems offer a choice of two backup methods. Each has distinct advantages and disadvantages, and understanding the differences can help get the most out of your tape backup system.

Image backup creates a "mirror image" of your disk: the directories and files are copied to the tape just as they occur on the disk. This includes the system files, the DOS file allocation table (FAT), and directory structure. While the image backup technique is the fastest method of backing up an entire hard disk, it also copies damaged files. And, since frequent changes cause files to be scattered in noncontiguous fragments on the disk, you can be sure that image backup will do nothing to improve data retrieval time on a highly fragmented file system. Finally, full restore from an image backup will overwrite the entire disk, wiping out data you may have wanted to keep.

In short, image backup is really useful only when you've had to replace your hard disk or when you want to replicate your entire system on another hard disk.

The **file-by-file** (or selective) method copies only the files or directories that you specify. While slower than image backup, selective backup stores each file as a contiguous stream of characters on the tape. Thus, restoring selectively backed-up files will result in the least amount of fragmentation (especially with a newly formatted hard disk). And, of course, system performance improves as file fragmentation is minimized.

The file-by-file method offers more flexibility than does image backup, and, depending on your backup software, you'll find options for backing up files by date, by modification since the last backup, or by directory and filename. This last option often allows you to use wildcard masks or point-and-shoot menus, or both. In addition, you can create lists of files to be included or excluded from every backup.

To sum up, the file-by-file method is more practical for daily use, allowing you to determine which files are to be backed up and how often.

—Richard Hale Shaw

Richard Hale Shaw is a software engineer and frequent contributor to PC Magazine.

(the backup software doesn't have to deal with directory structure and other overhead matters), restoration options can be more limiting. For instance, some image backups can be made only to an identical disk. Better systems are those which will allow you to restore individual files from an image backup.

File-by-file backup systems afford several methods of selecting which files are to be written to tape. Your choices often include specifying files by typing in filenames or some identifying characteristic, or tagging files by choosing them from a menu-like display.

Alloy's Tape System/2 takes advantage of the existing floppy disk controller and requires no special hardware or software installation.

Several identifying characteristics help you select files. The most popular of these, which should be expected as normal file-selection options, include archive bits (which indicate whether a file has been previously backed up), date stamps (which allow you to back up files that have been changed after a given date), and subdirectory searches (which include all files in the daughter directories of the one being backed up). Some software also lets you specifically exclude files from a backup session, either by name or by tagging.

Most tape systems allow you to give every backup session a name, which can be read later to identify a tape if, for instance, you neglect to label it. Many also allow you to embed a password so that your data security won't be compromised if a tape is lost or stolen.

Making backups is still as inviting as a pool encrusted with ice, but if your files are important to you, you've got to take the plunge. At least you'll find that these latest PS/2 systems have taken away some of the sting.

ALLOY COMPUTER PRODUCTS INC.

Alloy Tape System/2

A DC2000-based system that precisely follows the QIC-40 standard, Alloy's Tape System/2 installs internally in any Micro Channel PS/2 system. It takes advantage of the existing floppy disk controller and requires no special hardware or software installation.

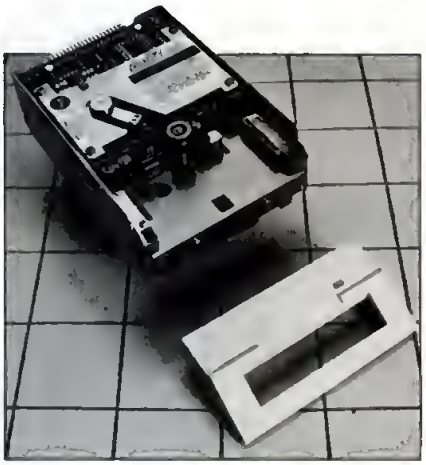
Alloy's *ResQ* software is a menu-driven, file-by-file backup system that lacks both a command-driven mode and image backup ability. However, it does permit you to automate your backup routine with its own batch mode that's built around special command files. An auxiliary program, TIPTOK, allows you to schedule up to ten backup sessions or any other DOS programs or batch files to run at an appointed time. The program waits in the background.

The on-screen appearance of *ResQ* is unusual—a forked approach that lets you choose backup, restoration, or utility functions either through a cursor-key-controlled moving bar or by pressing the initial letter of the command name. Files can be chosen by name, through all the normal selection options (archive bit, date), or by tagging an on-screen directory display. The restore process works similarly.

Alloy takes a bit longer than most systems to release control because it updates its tape directory *after* it finishes the backup session. This feature ensures that files changed during a backup session—which can happen on active networks—can be properly recovered.

During testing, an unusual aspect of the tagging process became apparent. After all the files in the elaborate subdirectory hierarchy were tagged, the backup session began normally, only to halt with the error message that the pathname was too long—in excess of 64 characters. However, *ResQ* handled the subdirectory hierarchy without a problem when the "backup all files" option was chosen.

That is, everything was fine until it was time for a restoration. The system again stalled with the error message about the pathname being too long. The net result is that the Alloy system is capable of making backups that it cannot restore—not a delightful situation to be in when your hard disk has crashed.



Few users need such lengthy pathnames, so, as a practical matter, this problem should not be of any consequence. Nevertheless, Alloy is correcting this design problem.

FACT FILE: Alloy Tape System/2; Alloy Computer Products Inc., 100 Pennsylvania Ave., Framingham, MA 01701 (617) 875-6100 **List Price:** $595 **Requires:** 512K RAM, PS/2 Model 50/60/80, DOS 3.3 or later.

CIRCLE 682 ON READER SERVICE CARD

ARCHIVE CORP.

Archive XL 3560

Designed for internal installation in floor-model PS/2s (Models 60 and 80), the Archive XL 3560 system is packaged as a complete kit with many more pieces than any of the other drive-in-the-slot products reviewed here. While most companies give you a drive and a disk as well as matching front panels to accommodate installation in a Model 50 or 60, the XL also includes two cables, a special mounting bracket, and a small circuit board. A companion model, the XL 3550, fits inside the Model 50.

Not surprisingly, the difficulty in installation increases with the number of pieces. You've got to dig into the bowels of your PS/2, pry off cables and brackets, slide the circuit board into tight confines, try to make the mounting bracket fit, plug in a control cable and a power cable, and slide in the drive.

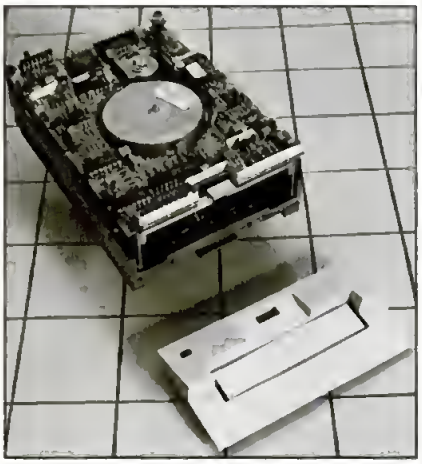
The process is actually worse than it sounds. The bracket is not easy to fit, the pins of the Archive-supplied power cable

Photographs: Thom O'Connor

did not line up properly and had to be bent to plug it in, and just getting the drive to slide into its slot was a struggle.

This subversion of the prime PS/2 directive (simplicity in all things and installations) might be justified by some enduring benefit, such as improved performance. It was not. The system performs on a par with other QIC-40 drives—that means a lot of waiting and none too fast once it gets going. Although it proved quickest of the DC2000s in restoring multiple short files, that's a function of software, not hardware.

Archive supplies a single, all-purpose



program for managing all aspects of the tape system—backup, restorations, and tape utilities. Called *QS* (for *QICStream*), it makes small demands on your system: only 256K of RAM necessary.

QS is a menu-driven program that allows quick and easy selection of files to back up or restore using all the normal file-choosing criteria. Backup sessions must be electronically labeled on tape and can be password protected.

The *QS* program works only in file-by-file mode. No image backup facility is available.

Although *QS* does not have a command-driven mode, it supports its own system of internal macros to automate backup sessions. It also has an alarm clock feature that allows the system to make automatic, unattended backups, even waiting in the background until the appropriate time to do so. Up to 17 sessions can be scheduled.

If you're willing to put up with its complex installation, you will be rewarded by a workable but not extraordinary backup system in the XL 3560.

Archive acknowledges the installation problem and is developing a simple plug-and-play QIC-40 system to replace the XL 3560 et al. As with similar drives from other manufacturers, one model will fit both the Model 50 and the Model 60. It will use the same *QICStream* software as the XL 3560 and should be available about the time this article appears.

FACT FILE: Archive XL 3560; Archive Corp., 1650 Sunflower Ave., Costa Mesa, CA 92626 (800) 237-4929 **List Price:** $499 **Requires:** 256K RAM, PS/2 Model 50/60/80, DOS 3.3 or later.
CIRCLE 681 ON READER SERVICE CARD

CIPHER DATA PRODUCTS INC.

Cipher Systems PC5125

Cipher is unusual among the makers of PC backup systems in that it manufactures its own tape drives and sells them under its own name. The PC5125 is based on a DC600-style tape transport mounted with a power supply in a compact case just the right size to sit atop a Model 60 or 80: 3¾ by 6¾ by 13½ inches (HWD). It also works with the Model 50. Two sets of rubber feet allow for either horizontal or vertical positioning.

The 15-track, 125MB capacity Cipher drive uses a lever to load the head against the tape and a rectangular button to eject tapes. That's about all you need to know to operate it. The system installs simply by sliding an Everex host adapter into your PS/2 and running the normal IBM setup procedures.

Cipher uses Sytron's *SY TOS* tape backup software without even relabeling it. The choice is not only a good one, but puts you in good company—IBM uses it, as well.

The 128K *SY TOS* program operates both in command- and menu-driven modes and, by using the program STBATCH, will generate its own batch files to automate your routine backup matters. Both file-by-file (with the usual file selection options) and image-backup modes are available. Individual files can be restored from an image backup.

In menu-driven mode, you work with a

Lotus-like moving-horizontal-bar selection system that divides the screen into several areas presenting messages, progress indications, and other information to you. Its display handled the lengthy pathnames of the test environment—over 60 characters long—quite elegantly, trimming intermediate subdirectory names and inserting an ellipsis in their stead.

Automatic backups use SYCLOCK, a background utility that starts applications or batch files at a predetermined time while letting you use your computer for other things as it waits.

The Cipher–*SY TOS* combination ranks among the fastest backup systems available for the PS/2. It streams tape as fast as the 72-inch-per-second tape will accept it: just over 2 minutes for 10MB, although rewinding time can add more than 90 seconds to a backup session. This hardware/software combination also gives you the security of the *SY TOS* quasi-standard (which is still waiting for the world to leap onto its bandwagon).

FACT FILE: Cipher Systems PC5125; Cipher Data Products Inc., 10101 Old Grove Rd., San Diego, CA 92138 (800) 4CIPHER **List Price:** $1,699 **Requires:** 512K RAM, PS/2 Model 50/60/80, DOS 2.1 or later.
CIRCLE 680 ON READER SERVICE CARD

CORE INTERNATIONAL

Core CT250

Despite their prodigious capacity of 250MB per tape, the Core International CT250 and its lower-capacity twin, the CT100, are among the most compact

PS/2 Tape Backup Systems: Summary of Features

(Products listed in ascending price order)

	Archive XL 3560 $499	Atlay Tape System/2 $595	Mountain FileSafe Series 4740 $595	Irwin 200P $649	Scientific Micro Systems Identica $699	Everex ST-80 $1,395
Capacity formatted (megabytes)	40	40	40	40.6	40	60
Price per megabyte	$12.50	$ 067	$ 067	$16.23	$17.48	$23.25
Internal or external	Internal	Internal	Internal	Internal	Internal	External
Tape drive interface	Floppy disk	Floppy disk	Floppy disk	Floppy disk	Floppy disk	DIC-02
Cartridge type	DC-2000	DC-2000	DC-2000	DC-2000	DC-2000	Data cassette
Size of unit	3½-in. form factor	3½-in. form factor	3½-in. form factor	3½-in. form factor	3½-in. form factor	2¾ × 7½ × 14 in. (HWD)
System specification	PS/2 Model 50	PS/2 Models 30/50/60/80	PS/2 Models 50/60/80	PS/2 Models 50/60/80	PS/2 Models 50/60/80	PS/2 Models 50/60/80
BACKUP FEATURES						
File-by-file backup	●	●	●	●	●	●
Image backup	○	○	●	●	●	●
Automatic backup	●	●	●	●	●	●
Background operation	○	●	○	○	○	●
Batch mode operation	●	●	●	●	●	●
Floppy-disk-drive emulation	●	○	○	○	○	○
OTHER						
Password protection	●	●	○	●	●	●
Electronic label on tape	●	●	○	●	●	●
Directory on tape	●	●	●	●	●	○

	Maynard MeynStream $1,695	Cipher Systems PC5125 $1,699	Core CT250 $1,836	Everex Excel II Stream $1,895	Mountain FileSafe Series 7120 $2,395	Tecmar DIC-125e $2,495	Emerald DDS 150-9007 $2,695
Capacity formatted (megabytes)	60 not formatted	125	250	125	120	125	150
Price per megabyte	$28.25	$13 50	$7 00	$15.00	$20 00	$20 00	$17.00
Internal or external	External	External	Both	External	External	External	External
Tape drive interface	D/CAS-6	DIC-02	DIC-02	DIC-02	DIC-02	DIC-02/Micro Channel host adapter	DIC-02
Cartridge type	600-XTD	DC-600	DC-600A-XTD	DCC-600	DC-600A	DC-600	DC-600
Size of unit	4 × 6½ × 15½ in. (HWD)	3¾ × 6¾ × 13½ in. (HWD)	3¼ × 6 × 13½ in. (HWD)	5½ × 7 × 16 in. (HWD)	7½ × 4 × 14¾ in. (HWD)	7¼ × 4 × 14¼ in. (HWD)	5½ × 9¾ × 12½ in. (HWD)
System specification	PS/2 Models 50/60/80	PS/2 Models 50/60/80	PS/2 (all models)	PS/2 Models 50/60/80	PS/2 (all models)	PS/2 (all models)	PS/2 Models 30/50/60/80
BACKUP FEATURES							
File-by-file backup	●	●	●	●	●	●	●
Image backup	●	●	●	●	●	●	○
Automatic backup	●	●	●	●	●	●	●
Background operation	●	○	●	●	○	●	●
Batch mode operation	●	●	●	●	●	●	●
Floppy-disk-drive emulation	○	○	○	○	○	○	○
OTHER							
Password protection	●	●	○	●	○	●	●
Electronic label on tape	●	●	●	●	○	○	●
Directory on tape	○	●	●	○	●	●	●

—Indicates Editor's Choice ●—Yes ○—No

tapes, measuring just 3¼ by 6 by 13½ inches (HWD). Their sharply rectangular metal cases reside comfortably atop a Model 60 or 80 (and are compatible with the Model 50 as well). The only difference between the two Core units is the particular model of Archive tape drive chosen. Both drives use a slider to lock tapes securely into place.

A plastic strap handle on the right side of the case makes the Core systems portable. Core sells the drives independently of the controllers, so one tape drive can serve many PS/2s.

As with most external PS/2 backup systems, installing either Core drive is a breeze. Slip in the full-length Everex host adapter card, connect a signal cable between the drive and PS/2, and run the standard IBM setup program. The CoreTape program can be used without installation, although because it sometimes writes to disk, performance is enhanced by copying its many files to your hard disk.

CoreTape provides separate menu-driven and command-driven programs. The former relies almost exclusively on function-key control and almost automatically guides you through the backup process. It also generates command files that work with the command-driven programs in batch files. Both file-by-file and image backups are possible, and individual files can be restored from image backups. Another utility allows unattended backups at an appointed time, but it does not wait in the background.

CoreTape transfers data from disk to tape as fast as the drive can accept it. However, its performance lags because it does extensive disk manipulations both before and after the backup, reading through the entire directory structure. While that may not be a problem with most systems, the elaborate test subdirectory hierarchy added minutes to the Core system's backup and restore times. Tape was completely rewound before the disk operations ceased and control returned.

The *CoreTape* software also added storage overhead, requiring over 2MB more tape storage than the 6MB used by the complex test environment on disk. The overhead appeared related to the number of directories and did not appear to be a percentage loss. Thus, with the same number of directories spread over 100MB, the penalty would still be only about 2MB.

Inexplicably, this same lengthy disk massage must be endured during image as well as file-by-file backups and restorations. If you have a relatively simple directory structure—say a few dozen directories—this disk work may not be a handicap. The performance of the Core system may suffer, however, in larger networked environments. Nevertheless, the awesome capacity of the CT250 recommends it for backing up today's big hard disks.

FACT FILE: Core CT250; Core International, 7171 N. Federal Hwy., Boca Raton, FL 33487 (305) 997-6055 **List Price:** $1,836 **Requires:** 256K RAM, PS/2 50/60/80, DOS 3.1 or later.
CIRCLE 679 ON READER SERVICE CARD

EMERALD SYSTEMS CORP.

Emerald DOS 150-9007

Based on DC600-style cartridges and a Tandberg tape drive, the Emerald DOS 150-9007 is a moderately large external backup system that mates with any Micro Channel PS/2. The 5½- by 9¾- by 12½-inch case attaches to the host system through a short, 3-foot cord that in effect dictates that the drive must sit on the ground or (with substantial overhang) atop floor-standing PS/2s.

As the model designation implies, the DOS 150-9007 is designed to work with DOS Versions 3.0 or later (separate versions are available for most popular networks); it stores up to 150MB per tape. The system connects to all Micro Channel PS/2 models.

Installation of the DOS 150-9007 involves the standard "slide in the Micro Channel card, plug in the drive, and run IBM setup procedure" routine. The whole process should take about 5 to 10 minutes.

Overall, the Emerald DOS 150-9007 is a good performer, moving data to tape as fast as the medium can absorb it.

Emerald supplies its *ASP (Archival Storage Protector)* software to control the DOS 150-9007. The entire system comprises a single 76K file that handles all of the backup, restoration, and tape utility functions.

The program is entirely menu-driven and has no command mode. In its stead, *ASP* learns, allowing you to develop inter-

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nal macros to automate your routine backup sessions.

Both file-by-file and image backups are permitted. However, *ASP*'s image mode works only with Emerald hard disk systems and does not allow individual files to be restored from an image backup. (Image mode could not be tested on the stock Model 60 used for these evaluations.)

ASP allows you to select files to back up by date but not by archive bit. Nor does it allow you to exclude specific files from a backup session. You can, however, electronically label your backup sessions and password-protect them if you like. Multiple backup sessions can be appended on a single tape.

ASP can be programmed to wait until a specific time to make a backup, but it does not operate in the background. You have to give up complete use of your system while it waits. The best way you can take advantage of this feature is by programming it to make a backup after you go home for the day.

Restorations work similarly. You can restore files to different volumes but not different directories. *ASP* protects against overwriting read-only files. If it encounters one, it stops and queries you whether it should do so—a process that may mean you have to babysit your restoration session.

Overall, the Emerald system is a good performer, moving data to tape as fast as the medium can absorb it. It waits until the tape is completely rewound until it returns control, however, which extends the time needed for a backup. Although its file restoration time for the elaborate directory structure was hardly lightning-fast, it handled the test with aplomb. The Emerald DOS 150-9007 is a yeoman system that will deliver good service if you don't need the file selection features it lacks.

FACT FILE: Emerald DOS 150-9007; Emerald Systems Corp., 4757 Morena Blvd., San Diego, CA 92117 (619) 270-1994 **List Price:** $2,695 **Requires:** 384K RAM, PS/2 30/50/60/80, DOS 3.3 or later.

CIRCLE 678 ON READER SERVICE CARD

TAPE BACKUP: THE SPEED IS IN THE SOFTWARE

Because PS/2 hardware can keep up with today's tape systems, backup speed is almost purely a function of the software used to control the various tape drives. How well the software deals with the disk to be backed up and its directory structure determines how quickly it can back up your system.

In the PC Labs tests, two aspects of backup performance were measured: the speed in streaming one 10MB file to tape, which shows a drive at its performance peak; and the time required to back up an elaborate subdirectory hierarchy consisting of about 1,575 subdirectories with two 2K files in each. This test pushes most backup software to its limits. The restoration time for both of these environments and the image backup time, if available, were also measured. (Image restoration closely follows image backup time; file-by-file restoration from image backups, when possible, generally conforms to the file-by-file restoration speeds.)

Most of the speed differences reported were rooted in the elaborate test subdirectory hierarchy. Many backup systems required an in-depth analysis of the entirety of the directory structure either before they allowed a look through their menus or as a preface to actual backup operation.

In some cases, two figures are used to report the performance of all systems that were tested. One represents the time devoted to actually backing up data, which shows the ultimate speed capability of the system. The second figure reports the time from loss of control of the system when the backup (or restore) operation begins to the moment control returns. This is the "downtime"—the time during which your system would be useless to you while the backup is being made. Besides the time required to stream information to tape, this figure also includes the rewinding time of the tape and any other overhead.

Rewind time complicates matters because it depends on the amount of data being backed up. In many systems, if the disk-based data is an odd multiple of the amount that can be stored in one pass of the tape, the entire tape will need to be rewound before control returns. When the backed-up data is an even multiple of the amount that can be stored in one pass, however, the tape is already back at its starting position (because of the bidirectional back-and-forth, or serpentine, recording method used by these systems) and would thus require no rewinding. Some systems also allow you to defeat the rewind process at the end of every backup—but that just delays the wait until the beginning of the next backup because all systems need to reference the beginning of the tape before they begin their operations, whether to read a directory or just to get their bearings. Other systems take care of rewinding while you're doing something else, so you don't waste time waiting. This is perhaps the most elegant way of dealing with the problem.—**Winn L. Rosch**

EVEREX SYSTEMS INC.

Everex Excel II Stream

Everex Systems manufactures a PS/2 host adapter that's used by many other tape systems. The Excel II Stream mates that adapter to a 125MB Archive tape drive in a large (5½- by 7- by 16-inch) metal box that more closely matches an AT than a PS/2. Although it overhangs the top of a Model

Unretouched Screen Images

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CIRCLE 532 ON READER SERVICE CARD

60 or 80 by somewhat less than an inch, that's where you've got to put it because of its short, 36-inch cable, which is permanently affixed to the case. The system also works with the Model 50.

In the Everex scheme, you first install the software using a prompted, menu-driven program, then attach the hardware—simply a matter of sliding the Everex host adapter into a vacant Micro Channel slot, plugging in the tape drive, and running IBM's setup utilities. Copying the automatic scheduling software takes an additional step. When you're done, you've got nearly a megabyte of backup software on your hard disk.

tions are available in the Advanced interface, including limiting backup to a specific closed-end date range (both beginning and ending dates can be specified).

During backups, the software takes a few seconds for preliminary work, then continuously streams data to disk except when files are short and many. It does not rewind after it is finished but immediately returns control to you. When you exit the program or select another function, the tape will rewind, but it does so in the background (actually even deeper, because it requires no microprocessor time at all).

Although the software is colorful and menu driven, its Advanced mode proved somewhat perplexing and at times confounding. No doubt you can get used to it, but not its lack of a command-driven or batch mode to automate your everyday backup routine.

The primary Everex backup software is actually a 760K-plus array of programs linked together by a master menu called TAPE. All of its selections load separate programs. Both file-by-file and image modes are available, with image files allowing only image restoration.

Although TAPE lacks a command-driven mode, its menu structure permits a batch mode for automating backups. This facility is complemented by scheduling software that runs in the background and starts applications at an appointed time.

The system is bifurcated into a beginner's interface, which allows the backing up of only one file or directory specification at a time, and an advanced interface, which supports multiple selections. All the expected file selection and exclusion op-

FACT FILE: Everex Excel II Stream; Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538 (415) 498-1111 **List Price:** $1,895 **Requires:** 256K RAM, PS/2 Model 50/60/80, DOS 3.3 or later.
CIRCLE 677 ON READER SERVICE CARD

EVEREX SYSTEMS INC.

Everex ST-60

By mating its own host adapter and a TEAC data cassette drive, Everex has made the ST-60 a fast and compact external backup system. Compatible with all Micro Channel PS/2 models, the ST-60 packs 60MB onto a tape that's the same size as—but not compatible with—a standard audio cassette. The drive, all the necessary control circuitry, and a power supply all fit into a low-slung, 2¾- by 7½- by 14-inch (HWD) mostly metal package that attaches to your PS/2 with a detachable cord that's 40 inches long.

Even before hardware installation, Everex recommends that you copy the adapter descriptor files to your setup disk. Afterward, the entire installation process takes but a few minutes—you need only slide the host adapter into your system, plug in the cables, and run the IBM setup procedure.

Software installation is automated by a special program. In a couple of minutes, it creates a subdirectory and copies all 760K of backup software there. If you choose to use the automatic backup scheduling facility that comes with the system, you'll need to give over another 65K bytes. The scheduler can initiate backups at a predetermined time and will wait in the background.

The Everex software comprises a number of programs united by a common control menu called TAPE. All the subsidiary programs share the same menu-driven interface with TAPE, and, in the normal course of things, you will probably never need to tangle with anything else at the DOS prompt level. However, you can use the batch mode of the TAPE software to automate routine backup sessions.

Normally you're confronted with a simple menu structure that limits your backup choices and possibilities. By pressing a function key combination, however, you enter the Advanced Interface, which adds all the normal file selection options to the program's repertory.

Both file-by-file and image backups are possible, but you cannot restore individual files from an image backup. Whenever you choose the backup function, the software reads through all disk directories, even if you choose to back up only a single file. On the complex subdirectory structure used in testing, this added about 1 minute, 20 seconds to all file-by-file backup times. Once the tape is rolling, it almost never stops streaming unless you have many, many very short files. A scrolling display of filenames and a horizontal ther-

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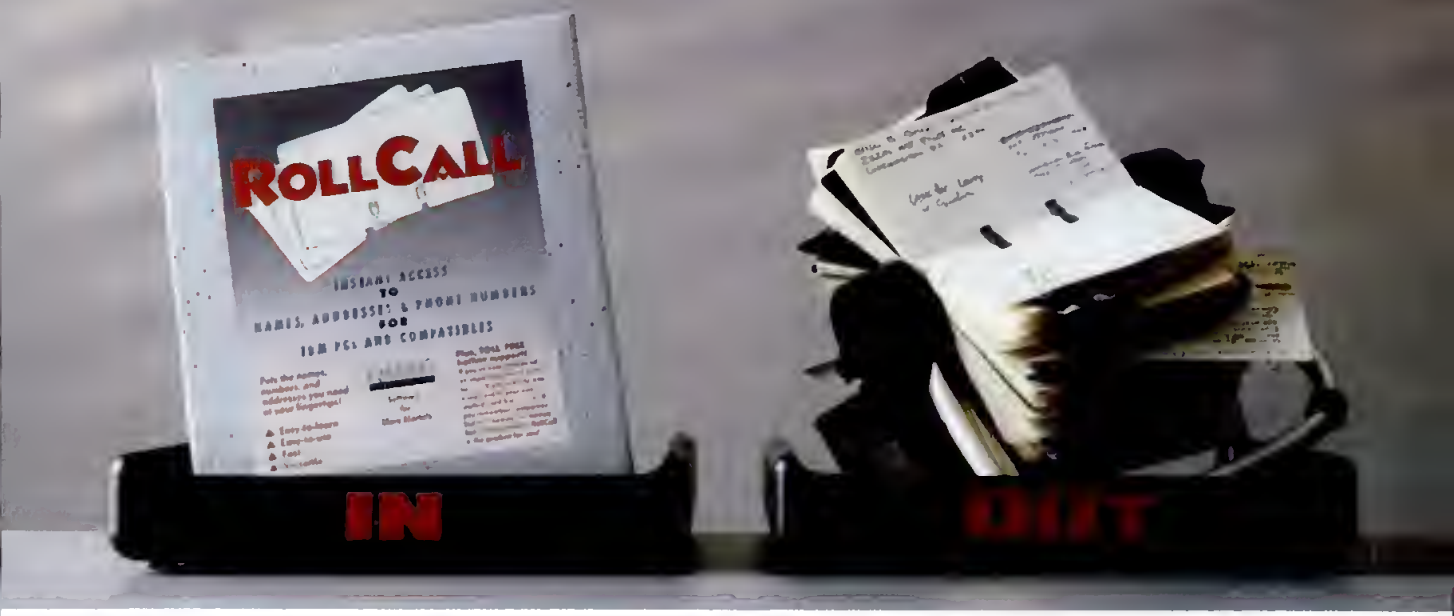
the "instant access" address system that puts your old card file in its place.



Does this situation sound familiar? You need to call a temporary service right away. So, you turn to your address file and flip through the Ts for "temporary." Not there. How about the Ss for "services" . . . the Ws for Will B. Quick Temporary Service . . . the Qs? Maybe somebody "borrowed" the card.

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- 8 input/output slots (6 16-bits, 2 8-bits)
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- Clock/Calendar with battery backup
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Mega 4000 4.77/8 MHz System
FEATURES:
- 8088-2 microprocessor with 8087 socket
- Keyboard selectable 4.77/8 MHz speed
- 4-layer mother board for higher reliability
- Expandable to 640K on board
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- System packing box

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CIRCLE 102 ON READER SERVICE CARD

mometer-style bar track backup progress.

Although the data transfer rate of the ST-60 is as fast as that of a DC600 system, performance lags because of the software overhead. Although this is a workable system, the Maynard MaynStream is a quicker cassette choice.

FACT FILE: Everex ST-60; Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538 (415) 498-1111 **List Price:** $1,395 **Requires:** 256K RAM, PS/2 Model 50/60/80, DOS 3.3 or later.
CIRCLE 676 ON READER SERVICE CARD

IRWIN MAGNETIC SYSTEMS INC.

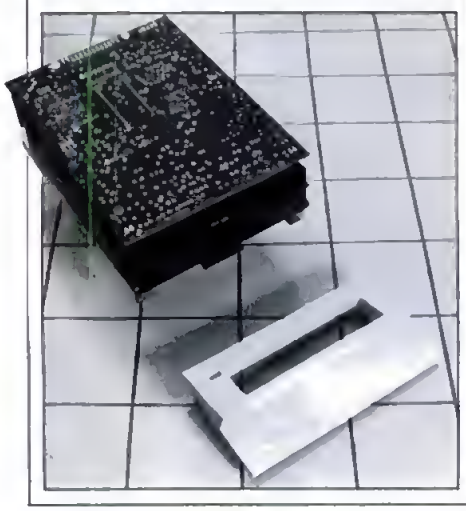
Irwin 200P

Irwin Magnetic Systems was the pioneer in small-cartridge tape backup systems for PCs. Over the years, capacities have grown from an initial 10MB per tape to the 40MB (on a DC2000 cartridge) of the internally mounting Irwin 200P that fits all Micro Channel PS/2 Models, from the 50 through the model 80.

Like Irwin's past products, the 200P is a standout and holdout when it comes to standardization. However, enough of its small drives are installed in PCs across the country that the Irwin proprietary tape format might be considered a standard of sorts.

The 200P follows the PS/2 philosophy of easy installation. It merely slides snugly into place, and then you run a single program—appropriately named INSTALL—that copies and configures Irwin's *EZTAPE* software.

EZTAPE tries hard to be exactly what its name implies. Nominally menu-driven, it also allows you to build "parameter files"—its own batch files for automating the choices you make through menus. Files can be selected through all the usual options or through a menu-oriented tagging system (but only by name in command-driven mode). File restorations are selected through similar systems that allow restoring files to different disks and directories. *EZTAPE* will also preserve or eliminate the original tree structure of your files upon restoration.



The 200P can also make automatic, unattended backups at an appointed time using the background program EZSTART. In addition, Irwin supplies three separate batch files that give you an instant, no-decision backup system: BACKALL makes a full backup of your entire hard disk. CHANGED then backs up only those files that have changed since your last backup (determined through archive bit). RESTALL restores your entire disk from these backups. It's a simple, elegant solution if any thought about backing up is too much for you.

Although Irwin sells tape cartridges for

THE OUTER LIMITS OF TAPE BACKUP

These days, it's not unusual to encounter a PC or file server crammed with hundreds of megabytes of mass storage capability. As gigantic hard disks become more prevalent in both networks and high-end PCs and workstations, concern about how to back up safely those hundreds and even thousands of megabytes of data becomes a serious issue.

This year, several streaming-tape-backup manufacturers are working to forge new standards and specifications that will allow for the development and marketing of 1-gigabyte streaming-tape-backup drives by the early 1990s.

According to Stan Miller, a market development manager at 3M Corp., a company on the vanguard of magnetic media development, several manufacturers of media and tape backup drives have consulted under the auspices of the Quarter-Inch Compatibility (QIC) group to set the specifications that will make all aspects of this new generation of backup devices and media fully compatible.

Miller said that today's backup technology can and will be tweaked up to a maximum storage capacity of approximately 320MB. Tape speeds will be increased from 90 inches per second to 120 ips, and developers hope to expand the ranges of temperature and humidity that the tape can tolerate.

But Miller added that true innovation will be necessary to meet the huge demands of data storage in the next decade. The key to getting a full gigabyte of data onto one tape will be through increasing the data density of the quarter-inch tape itself, and, once the cartridges and drives exist, they will have to be fully backward-compatible with the midrange backup devices they replace.

And 1-gigabyte storage will not be valuable just for traditional data-intensive applications like CAD and computer-aided engineering: Miller pointed out that the boom in desktop publishing is leading to the design of very long, graphics-filled documents that fill many megabytes of storage space.

"Backup isn't the most visible aspect of microcomputing," Miller said, "but more and more people are going to be dealing with the kind of 'supermicrocomputers' that have hundreds of megabytes of storage. It will become a vital area of concern in the 1990s."

Anyone who can't wait until the '90s for the new systems to arrive can turn to Emerald Systems Corp. of San Diego, which currently markets the Vast Device, a 2.2-gigabyte backup subsystem that uses helical scan (VCR-based) recording methods.—**Donald P. Willmott**

Donald P. Willmott is an assistant editor of PC Magazine.

PS/2™ TAPE BACKUP. RELIABLE. AFFORDABLE AND AVAILABLE.

FEATURES	MOUNTAIN TD4000
New QIC-40 Standard	YES[1]
LAN Support	YES—Novell,[2] 3Com,* PCnet,* TOKEN RING* and more
Concurrent LAN Backup	YES—backup while network is running
Dual Floppy Support	YES—runs with both floppy drives installed
IBM PS/2 & PC Compatible	YES—Models 25, 30, 50, 60 and 80; PC, XT, XT286* and AT
High-Speed Rewind	YES—25 seconds
Automatic Track Alignment	YES—assures data interchange even on mis-aligned tracks
Fast Formatting	YES—single pass
Advanced Data Recovery	YES—compensates for faded or worn tapes
Auto Tape Erase	YES—automatic during formatting
Full Shock Mounting	YES
Menu-Driven Software	YES—RATED BEST
Reliability	YES—Level 3 Reed-Solomon ECC

[1]QIC-40 is the first cartridge data standard ensuring file transfer compatibility between multiple manufacturers' drives.
[2]FileSafe has been tested and approved by Novell.

Mountain delivers the first tape backup system for the new IBM® PS/2™ computers (Models 25, 30, 50, 60 and 80).

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Compared to the competition, FileSafe Series 4000 provides more advanced features, greater LAN support, and easier-to-use software. It's also faster, more rugged and requires less power.

And unlike some tape backup systems, it incorporates the new international cartridge interchange standard (QIC-40) that now makes reliable tape backup more affordable than ever.

Plus it comes with Mountain's unique 12-month limited warranty featuring "Ready Replacement" anytime within the first six months, and a 10-year record of responsive support.

LOOK TO MOUNTAIN.

Take a close look at our FileSafe Tape Series 4000. You'll quickly see why tens of thousands of professional, business and government systems users worldwide come to Mountain for the best values in tape backup. Call us today for more information and the name of your nearest Mountain dealer or distributor.

PC MAGAZINE EDITOR'S CHOICE

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THE PEAK OF PERFORMANCE

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CIRCLE 240 ON READER SERVICE CARD

the 200P already formatted, *EZTAPE* allows you to initialize your own or recycle used tapes without reformatting them.

Because it uses your PS/2's built-in floppy disk controller, the 200P is somewhat limited in its data transfer rate. Nevertheless, it keeps its ribbon of media streaming most of the time, and on pure data transfers it's reasonably quick—at least compared to its laggardly handling of filenames and directory structures. The 200P was the slowest of all systems in backing up our entire hierarchy of 1,500-plus subdirectories.

While Irwin's software does have a few warts—asking the system to overwrite a previous save set when the tape was blank tied together an endless loop—overall the Irwin system is well integrated and very workable. You'll just have to be patient.

FACT FILE: Irwin 200P, Irwin Magnetic Systems Inc., 2101 Commonwealth Blvd., Ann Arbor, MI 48105 (313) 996-3300 **List Price:** $649 **Requires:** 512K RAM, PS/2 50/60/80, DOS 2.1 or later.
CIRCLE 675 ON READER SERVICE CARD

MAYNARD ELECTRONICS INC.

Maynard MaynStream

A compact, squarish metal box with a folding metal handle on the rear, the Maynard MaynStream for the PS/2 allows you to shuffle one external, cassette-based tape drive among multiple computers. Built around a TEAC tape transport and a Maynard PS/2 host adapter, the MaynStream provides 60MB of backup per data cassette for any model Micro Channel computer. Its 4- by 6½- by 15½-inch case (HWD) just fits atop a floor-standing PS/2, the place you'll probably want to put it because of its short, 3-foot umbilical tether.

Hardware installation is simply a matter of sliding in the host adapter, plugging in the connecting cable, and running the IBM hardware setup routine. The details involved in managing the installation of the near-megabyte (911,360 bytes) of software are handled automatically by a dedicated installation program.

Maynard supplies both menu- and command-driven programs to control the operation of the system. The menu-driven program, TMENU, uses a moving-horizontal-bar system that will allow even neophyte users to make a first backup within minutes. Backups can be password protected and electronically labeled.

MaynStream's file-by-file mode supports all normal file-selection options, allows appending new sessions to a used tape, permits restorations to any drive or directory, and incorporates both verify and archive (backup and delete) functions. Its image mode streams data from all disk clusters to tape (including unused and bad clusters) and does not permit individual files to be restored.

Backup specifications can be saved in a script file to automate routine but elaborate backup sessions. These automatic backups can also be made unattended using the background program AUTOBACK.

You can create your own backup batch files using the command-driven programs (TBACKUP and TRESTORE) that Maynard also supplies.

The small system proved fleet indeed, yielding the quickest single-file backup sessions of all the units tested. The fast-as-DC600 speed of the cassette medium was enhanced by the MaynStream system's releasing control as soon as the backup was completed, without waiting to rewind the tape. If storing megabytes on cassette doesn't scare you (the tapes lack the sturdiness of DC600 cartridges), the MaynStream is a top backup choice.

FACT FILE: Maynard MaynStream; Maynard Electronics Inc., 460 E. Semoran Blvd., Casselberry, FL 32707 (305) 331-6402 **List Price:** $1,695 **Requires:** 512K RAM, PS/2 50/60/80, DOS 2.0 or later.
CIRCLE 674 ON READER SERVICE CARD

MOUNTAIN COMPUTER INC.

Mountain FileSafe Series 7120

Although it's from the old PC school of design, the "zero footprint" Mountain FileSafe Series 7120 takes full advantage of the PS/2 Micro Channel to make what just may be the ultimate backup system. The vertically mounted Wangtek tape drive in its 7½- by 4- by 14¾-inch case packs up to 120MB on a DC600-style cartridge, and its control software wastes little of your time with overhead.

The Mountain host adapter slides into a vacant expansion slot in any Micro Channel PS/2, Model 50 and up, and connects to the drive unit through a 5-foot cable. After the normal IBM hardware setup, you can install the software into its own MTN_TAPE hard disk subdirectory as easily as typing INSTALL. The system, which occupies about 720K of disk, can even be adapted to foreign languages (German and French) with auxiliary language diskettes.

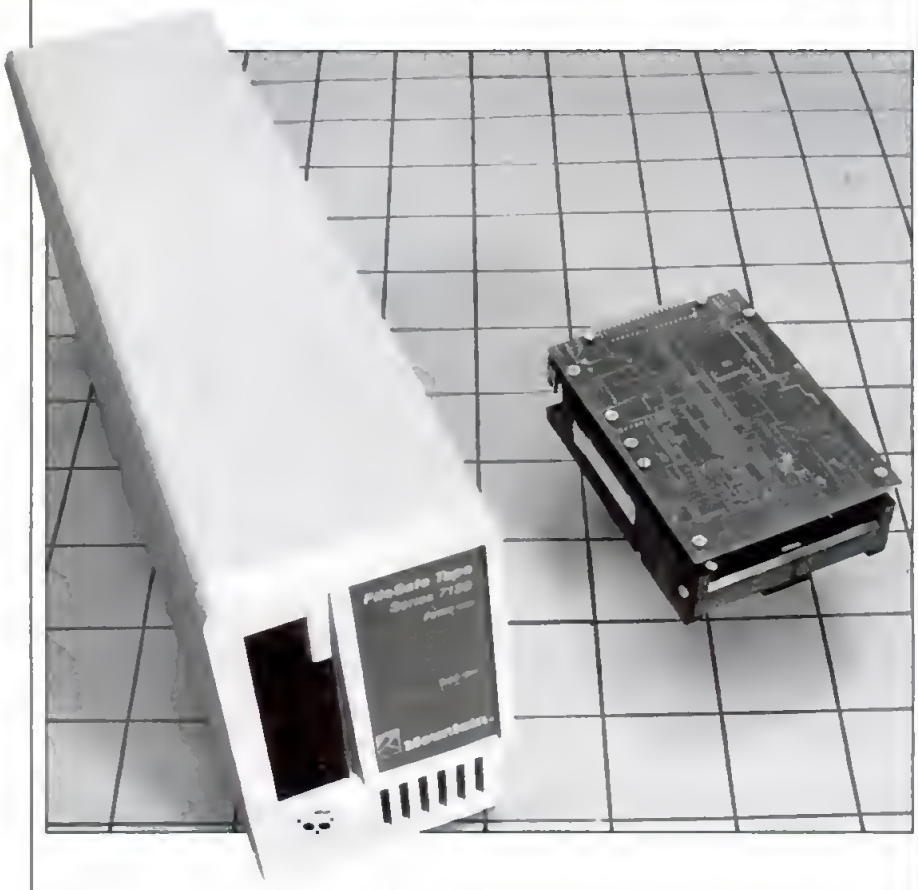
One menu-driven program, TAPE, is supplied for backup, restore, and tape system management functions. In addition, separate command-driven utilities are available for each individual function. You can use the command-driven utilities to automate your backup sessions and, using a special AUTORUN utility, make automatic, unattended backups. AUTORUN operates as a background process, so you're free to use your computer while it's waiting to back itself up.

The Mountain FileSafe software supports both file-by-file and image backups. The former allows all normal file selection options and, in menu-driven mode, even allows you to tag files from an on-screen directory display. Image backups, called "full" backups by the FileSafe system, copy all disk sectors (including unused ones) to tape and do not allow restores of individual files or restoring to different-size disks.

Once you've selected files and passed all the FileSafe queries, the system responds quickly, and in most cases it's able to stream data to tape as fast as the drive will accept it. Control returns to you shortly after the backup is completed, even before the tape is fully rewound. Alternative-

ly, the system can be configured to verify the backup session automatically with a tape-to-disk comparison (an option most useful and desirable for unattended backups).

The FileSafe software also proved to be efficient (but not the most efficient one we tested) in handling the elaborate test subdirectory hierarchy, and its release of control before rewinding made its high-speed streaming seem even quicker. It was fastest among the DC600 units tested, and only a bit slower than the cassette-based Maynard (primarily because the Maynard could be operated without requiring a tape rewind after making a backup). For fast, secure backups, the Mountain FileSafe Series 7120 is a top choice.



FACT FILE: Mountain FileSafe Series 7120; Mountain Computer Inc., 360 El Pueblo Rd., Scotts Valley, CA 95066 (408) 438-6650 **List Price:** $2,395 **Requires:** 256K RAM, PS/2 50/60/80, DOS 2.1 or later.

CIRCLE 673 ON READER SERVICE CARD

MOUNTAIN COMPUTER INC.

Mountain FileSafe Series 4740

Mountain combines its proven FileSafe software with its own DC2000-style tape drive to make the 4740 a QIC-40–standard internal backup system for all Micro Channel PS/2 models. It slides into a vacant 3½-inch floppy disk drive bay and interfaces through the existing floppy disk controller circuitry.

The system packs up to 40MB on a single cartridge. As with floppy disks and other QIC-40 tape drives, Mountain cartridges must be formatted before use—a process that requires about 40 minutes. Although the Mountain software has a built-in cartridge-erase function, the process takes as long as formatting. Other manufacturers supply erase utilities that do their deeds (by clearing the tape directory) in a few dozen seconds.

Unlike its big brother—the Series 7120 drive—the Mountain 4740 does not return control of your system to you after it finishes streaming data to tape. Instead, it must rewind the cartridge, then update the directory before your computer becomes usable again.

The 720K of FileSafe software appears identical to that supplied with the larger drive and offers the same easy installation, foreign language support, and all the features. Both menu- and command-driven programs are supplied for backup, restoration, and system utilities for both file-by-file and image-based mode; all the expected file selection options are also available. Files stored through image backups cannot be individually restored.

Although the 4740 is not a standout among other DC2000-based drives (as the 7120 is among DC600s), it works well within the confines of QIC-40 and is a good alternative should that be the format you choose.

FACT FILE: Mountain FileSafe Series 4740; Mountain Computer Inc., 360 El Pueblo Rd., Scotts Valley, CA 95066 (408) 438-6650 **List Price:** $595 **Requires:** 256K RAM, PS/2 50/60/80, DOS 2.1 or later.

CIRCLE 672 ON READER SERVICE CARD

SCIENTIFIC MICRO SYSTEMS INC.

Scientific Micro Systems Identica

Perhaps best known for its hard disk controllers, Scientific Micro Systems enters the backup marketplace with its Identica. Based on a 3½-inch DC2000-style drive made by Alloy, Identica adds *SY TOS* software to make a complete 40MB-per-cartridge backup system that's close to but does not precisely follow the QIC-40 standard.

Identica slides into a vacant floppy disk bay in a Model 50 or 60—SMS includes bezels for both systems—and takes advantage of the system's built-in disk controller. Other than copying the backup software, no use of installation hardware or software is required—not even running the system setup procedure.

SY TOS gives you a menu-driven interface with the option of command control for both file-by-file and image backups

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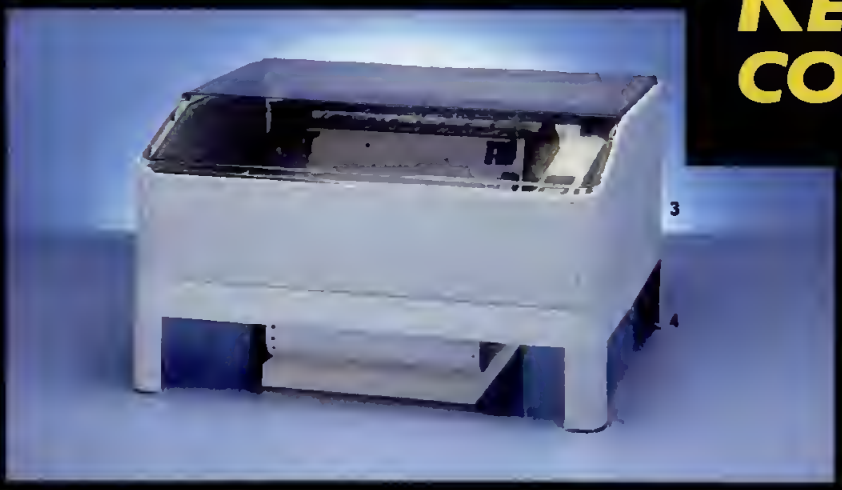

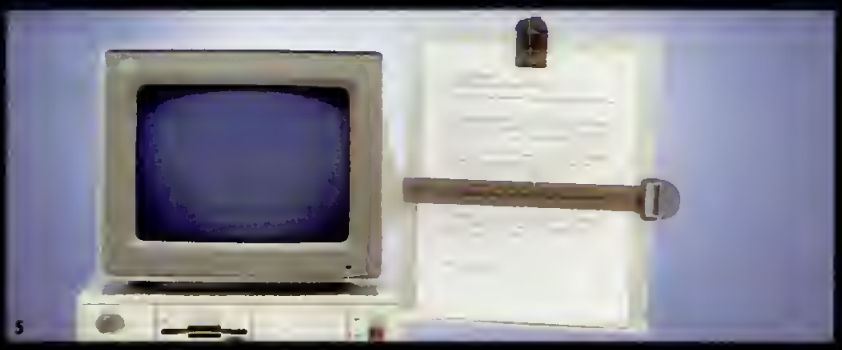

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CIRCLE 272 ON READER SERVICE CARD

Performance Tests: PS/2 Tape Backup Systems

The overall results for the PC Labs Bigfile test of 13 internal and external backup tape drive units show that DC600- and cassette-based systems hold a substantial speed advantage over DC2000 technology. The primary reason for this speed difference is the data transfer rate of the QIC-40 standard, which is limited by the floppy disk interface used. Scatter test speeds are influenced more by software than by tape hardware; consequently, the performance of systems using different standards overlaps.

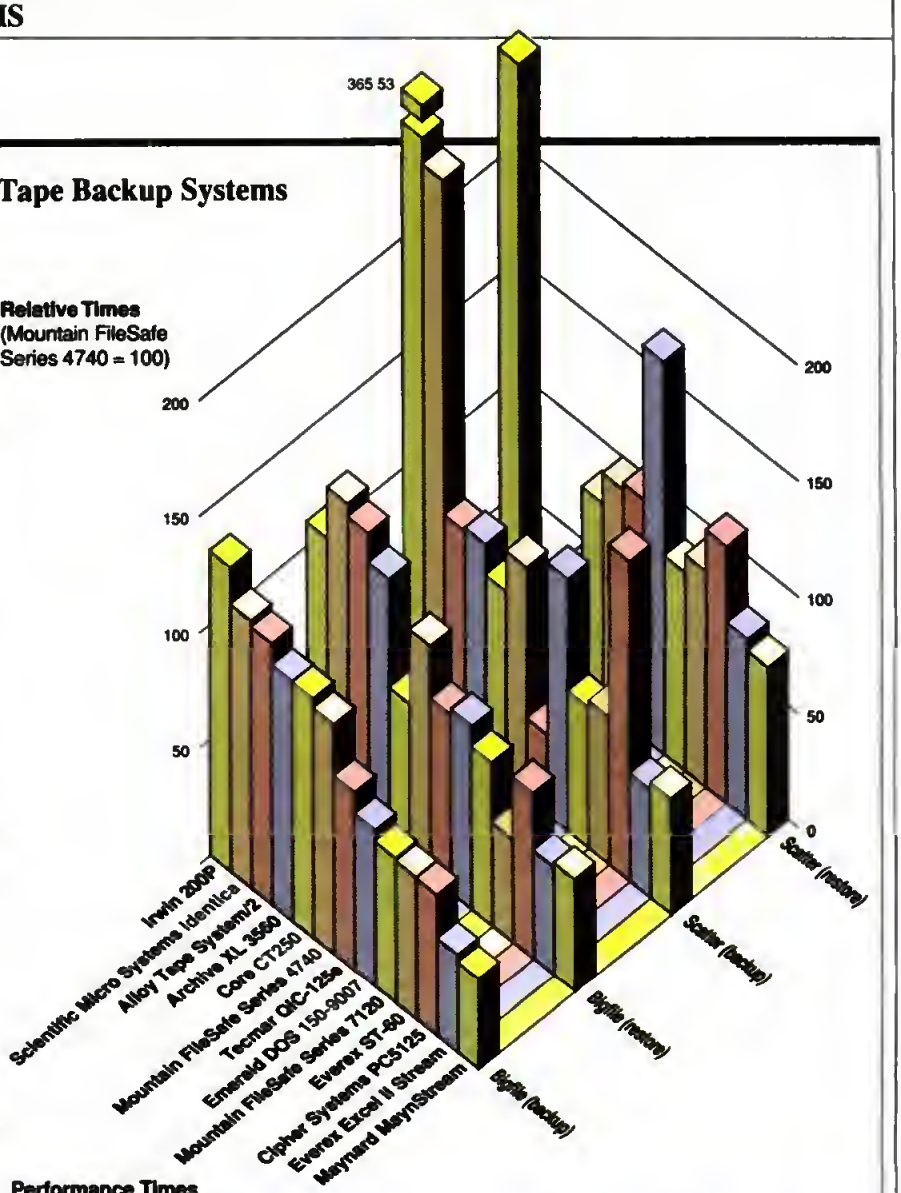
The cassette-based systems appear fastest because they ordinarily do not rewind tape at the end of each backup session, delaying the process until later (when it still must take its toll). Even though the Maynard MaynStream proved to be the fastest, the Mountain FileSafe Series 7120 external system stood out because it released control while the tape was still rewinding and did a good job handling multiple files. Also boasting exceptional times was the Everex Excel II Stream.

While giving a poor showing in the Bigfile backup and restore cycle, the Tecmar QIC-125e proved best at handling the Scatter environment. Its Bigfile speed suffered because of the need to write a tape directory at the end of each session: this procedure adds to backup time but may speed both the restoration of individual files and backups when additional files are appended to a tape.

The Alloy system failed the Scatter restoration because of a software quirk that the company claims to have corrected. It is a highly competitive drive despite this minor failure. The SMS Identica software, however, crashed during all three restoration tries, and a replacement disk of software supplied by the company did nothing to fix the problem. Once this bug is swatted, the Identica should be a viable backup system.

The **Bigfile** performance test backs up a single 10,000,000-byte file and shows the top speed of a backup system under the most favorable circumstances. The **Scatter** performance test backs up 3,156 2K files in 1,578 directories (in addition to COMMAND.COM and CONFIG.SYS files in the root directory). This test reveals how well backup software handles multiple short files and complex directory structures.

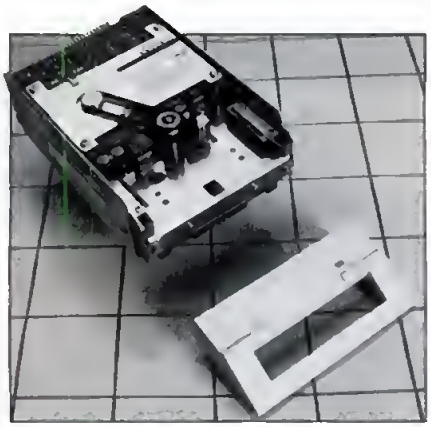
The results given represent the total time measured from the last keystroke of the backup until the backup was completed and control returned to the user after rewinding the tape (where these times were different). This represents the actual time that the system would be occupied and unusable during the backup session. Rewind time is represented separately from the rest of the timing, since it varies with tape length and with the relationship of the amount of data being backed up to the capacity of a single tape track.



Performance Times
(Times given in seconds)

	Bigfile (backup)	Bigfile (restore)	Scatter (backup)	Scatter (restore)
Irwin 200P	434	312	2,895	3,993
Scientific Micro Systems Identica	382	374	1,890	N/A†
Alloy Tape System/2	373	358	745	N/A*
Archive XL 3560	343	323	758	768
Core CT250	342	192	654	1,399
Mountain FileSafe Series 4740	329	282	792	1,611
Tecmar QIC-125e	255	218	281	1,657
Emerald DOS 150-9007	224	225	866	2,727
Mountain FileSafe Series 7120	208	200	487	1,380
Everex ST-60	204	126	508	1,503
Cipher Systems PC5125	203	203	1,095	1,789
Everex Excel II Stream	141	133	373	1,266
Maynard MaynStream	130	138	397	1,184

N/A*—Not applicable: unable to restore subdirectory hierarchy.
N/A†—Not applicable: system crashed before restoration was completed (all three tries).



and restorations. You can even restore individual files from image backups. All the normal file-selection methods are available, including a pick-and-choose directory display. Both labels and passwords can be electrically appended to your backups. Optionally available but not included with the Identica system are *SYTOS*'s batch file generator (STBATCH) and SYCLOCK programs for scheduling automatic unattended backups.

The DC600-based Tecmar QIC-60 was one of the first "zero footprint" external tape backup systems. It has been updated with more tracks to yield the QIC-125e.

Because it uses the same floppy disk interface, the Identica streams data to tape at the same rate as other QIC-40 drives. However, when it comes to actual data throughput, it suffers from waiting time. You have to stare at a Sytron logo on your monitor screen as the tape spends 20 to 30 seconds getting itself ready, then endure another wait when performing any operation while the tape directory is read. You'll also have to format tapes before you use them (unless you buy preformatted cartridges). If you demand instant response, this is not a system for you.

System performance further suffered when handling the complex directory structure of the test environment. Worse were the many times that the system inexplicably suffered an untimely death. While the message "WAIT" was posted in the upper-right-hand corner of the screen, all disk, tape, and host computer operations came to a halt, with nothing changing for such long periods (half an hour) that we had to resort to rebooting the computer. In three tries, the system never lived long enough to restore the entire 3,100-odd files in the test environment. Our time is an estimate based on the number of files that were restored during the period in which the system operated.

FACT FILE: Scientific Micro Systems Identica; Scientific Micro Systems Inc., 339 N. Bernardo Dr., Mountain View, CA 94043 (415) 964-5700 **List Price:** $699 **Requires:** 256K RAM, PS/2 50/60, DOS 2.1 or later.
CIRCLE 671 ON READER SERVICE CARD

TECMAR INC.

Tecmar QIC-125e

Among the first "zero footprint" external tape backup systems—and the best-selling one (at least according to its manufacturer)—the DC600–based Tecmar QIC-60 has been slightly restyled and updated with more tracks to yield the QIC-125e. The system stands like a tall gray-and-beige bread loaf, with a 7¼- by 4- by 14¼-inch (HWD) plastic-and-steel case that is built around a Wangtek 15-track quarter-inch cartridge drive.

Its front panel reveals more about what's going on inside than that of any other system. A column of indicators shows not only read and write operation and the direction of tape travel, but also the track that's currently being worked on.

Installation is quick and painless—just insert the full-length expansion board and run normal IBM setup utilities. Tecmar's *QualityTape* software requires no installation of its own other than copying its files to a hard disk should you want to do so. You can alter various program installation options at any time. For those who require standardization, *SY TOS* software is optionally available with the QIC-125e.

QualityTape is both menu- and command-driven. It also generates its own batch files to automate the backup process. All normal file-selection options are available for both backup and restore operations. The program has an image backup mode but, unlike earlier Tecmar products,

PC MAGAZINE EDITOR'S CHOICE

- **Maynard MaynStream**
- **Mountain FileSafe Series 7120**

Speed is not the only reason for choosing a backup system, but among these units the fastest proved to be the friendliest, too. The Mountain FileSafe Series 7120 would be our top choice because it uses the proven DC600-style cartridge and gives a versatile, easy-to-use package of control software. Only a more intelligent image backup utility (one that operates exclusively on active clusters and allows individual file restoration) is lacking.

The Maynard MaynStream makes the cassette medium very attractive. When streaming, it's as fast as the big drives, and its 60MB capacity should be enough for anyone.

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CIRCLE 378 ON READER SERVICE CARD

EXCERPT FROM PC WEEK REVIEW MARCH 8, 1988 USED WITH PERMISSION

Database Add-In for 1-2-3 Has More Capabilities Than Rivals

by Marvin Bryan

The king of the crowded forest of Lotus 1-2-3 database add-ins is unquestionably @BASE...

@BASE was developed by Personics Corp. of Concord, Mass., makers of the popular SeeMORE utilities that add additional columns to the screen displays of Lotus 1-2-3 and Symphony.

With @BASE, it's possible to build colossal 32 M-byte databases in the standard dBASE III Plus format without ever using dBASE itself. Users can convert a normal 1-2-3 database instantly into a dBASE-compatible file, as well as set up dynamic links that will import updated information from dBASE records every time a worksheet is recalculated.

A database can be sorted alphabetically, numerically or chronologically on as many as 128 levels. In fact, @BASE will pack and sort records as much as three times faster than dBASE.

Data can be analyzed with a cross-tabulation module to provide lightning-fast reports in response to such questions as "What sales people in each division earned more than $20,000 in commissions this month?"

In addition, records can be entered or examined in a form view, where each record occupies an individual screen. Alternatively, of course, the user can choose the usual one-record-to-a-line format.

We tested the current $195 release of @BASE along with a beta copy of the Option Pac, which will retail for $89.95. **Together, these two relatively inexpensive products provide truly remarkable functionality.**

In addition to the indexing feature, the Option Pac will join files to make relational databases, create computed or derived fields, sort a database without rearranging the records on disk, and automatically keep files in the correct sorting order during record entry or updating.

See our ad on page 63.

As a bonus, dBASE data can be turned into 1-2-3 graphs with practically no effort at all...

Personics has developed a series of @DB functions to perform calculations and evaluate records within @BASE. Each of these functions use one or more arguments to identify the database, record or field to be acted upon. Some functions allow criteria to be established, such as selecting a subset of records.

The 200-page manual for @BASE is excellent. The program adds less than 80K bytes to the RAM overhead of 1-2-3. **For those who use both dBASE and Lotus 1-2-3, @BASE is practically a requirement.** ■

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■ PS/2 TAPE BACKUP

does not allow individual files to be recovered from an image backup.

QualityTape is unusual in that it reads the entire disk directory structure into memory before you can select files. With the complex subdirectory hierarchy used for testing, that added about a half-minute wait. Worse, however, is that *QualityTape* holds the directory structure in RAM even while backing up, which during testing cut down on the memory available for buffering and increased backup time by fourfold. Although some of the program's handicap can be eliminated by paging the directory to disk (an installation option), this process added about 15 seconds to the backup times.

Tecmar uses its own tape format, which includes a tape directory. While writing the directory adds another half-minute to backup times, it actually speeds the handling of multiple directories, subsequent backups to the same tape, and individual file recovery because the system knows where each file is on the tape. In fact, the QIC-125e proved to be the most adept at backing up the test subdirectory hierarchy. Hence, if you need to do a lot of individual file recovery, this may still be the system to choose.

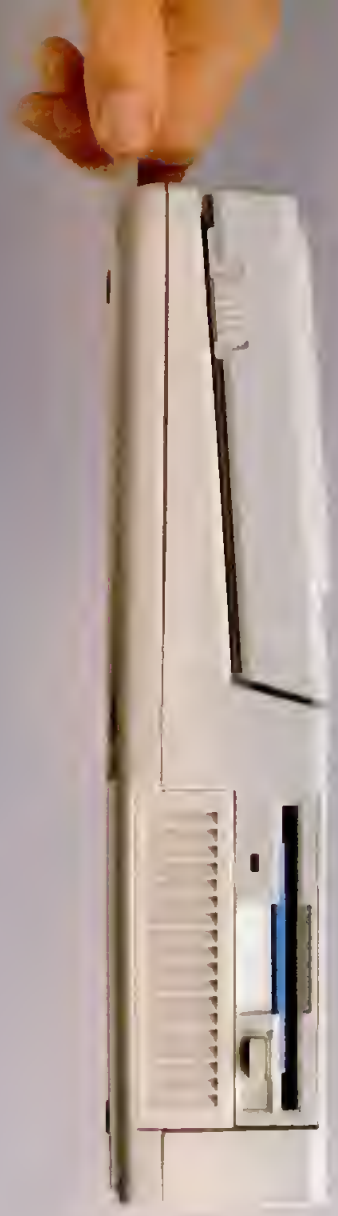
Tecmar's *QualityTape* software requires no installation of its own other than copying its files to a hard disk should you want to do so. You can also alter program installation options.

FACT FILE: Tecmar QIC-125e; Tecmar Inc., 6225 Cochran Rd., Solon, OH 44139 (216) 349-0600 **List Price:** $2,495 **Requires:** 64K RAM, PS/2 50/60/80, DOS 2.0 or later.

CIRCLE 670 ON READER SERVICE CARD

PC

Winn L. Rosch is a contributing editor of PC Magazine.



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ARTWORK BY TODD WINTERS

Don't worry. Even if you catch T.W. 'Dillo manning the phones at Intelligent Micro Systems in San Antonio, you don't have to speak Armadilloese to communicate your desire for an IMS personal computer system. In fact, you don't even have to speak Texan, says T.W.

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T.W. didn't sleep during classes. And he makes sure Intelligent Micro Systems offers quality computers at prices that would have made ol' D.P. Armadillo proud.

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CIRCLE 498 ON READER SERVICE CARD

KING COLOR

Ink jet and thermal transfer printers from CalComp, Hewlett-Packard, Mitsubishi, Seiko, and Tektronix give you high-quality color in PC graphics.

NEW PRINTERS BANISH BLACK AND WHITE

In a world where color is king, monochrome means small budgets or big-name artists in the fields of still photography and moviemaking. But when it comes to computer printers, the world is turned inside-out. Machines using color technology proliferate at both the bottom price rungs and the top—but these machines are conspicuously absent from the middle range.

Part of this anomaly is easily explained: until recently, most color printers gave bad results. When it comes to color, after all, quality counts.

The crop of color printers examined here stand out because these machines no longer suffer a quality handicap. Using

bright inks and new technologies—multiple-nozzle ink jets and thermal-wax printheads—some of them create clear, saturated images with resolutions as high as those of laser printers. Several have color palettes even broader than the 262,144 tints of the VGA system.

Another nagging problem with color printers—part of why they have lagged miserably behind their monochromatic kin—has been slowness. By using line-printing technology, however, many of the latest generation of color printers have cut the time needed to generate a page to one-quarter or less that of earlier machines, and to a small portion of the eons required to produce each image when using rival color-plotter technology.

Convenience counts, too. In photography, many darkroom amateurs still stick with black-and-white because of the demands and complexities of color. In printing, convenience is one place where, unfortunately, even the latest and greatest color printers fail. While much improved, none of them approach the simpler one-hue machine when it comes to physical or logical ease of setup and use.

Loading a color printer with ink or ribbons can be trying, indeed—particularly when compared with the few seconds it takes to slip a cartridge into your Epson FX-80. Setting up a color printer and getting it to work harks back to Dr. Frankenstein's challenge to make a working system from some very unmatched parts.

Ink jet machines require you to refill them regularly with potentially messy liquid ink, perhaps as often as after every dozen heavily blackened sheets. Thermal-wax machines make you load rolls of color-laden Saran-type wrap after as few as 80 copies.

Cost, too, militates against color in computer printers. The least expensive of the machines here rivals a laser printer in cost (but not speed or quality). At close to $10,000, the top end will break all but the biggest budgets.

Indeed, none of these machines can be regarded as products for the hobbyist user of PC paint products. They fall into the price realm of the corporate graphics department: one machine intended to serve the whole company, meant to be shared and distributed, and made with corresponding ruggedness. They're at their best in high-volume use, making vivid hard copy for special reports and attention-getting transparencies for presentations.

TECHNOLOGICAL LEAP Although these machines use two distinctly different technologies and fall correspondingly into separate price segments, their output speeds and on-paper image quality overlap. Both types of machines are capable of generating display-quality pictures either on paper or on transparency film suitable for overhead projectors.

The ink jet machines from Hewlett-Packard and Tektronix simply add a different sort of printhead to a seemingly conventional mechanism that moves it back and forth across the sheet being printed. The ink jet mechanism uses tiny nozzles to

OVER THE RAINBOW: COLOR LASERS SLOW TO DEVELOP

With the debut of relatively inexpensive laser printers in 1984, the whispers were not far behind: Are color lasers on the horizon?

Through a joint venture, QMS and Colorocs are saying *yes*: the first color laser is due out this summer. Boasting 4 to 6 color pages per minute at 300 dots per inch, the printer produces 22 monochrome pages per minute for users requiring both black-and-white and color.

But other manufacturers are hesitant to jump into this uncertain market. "Many people think that what happened with the LaserJet will happen in color lasers," said Bill Loeber, product marketing manager for Hewlett-Packard's San Diego division. "But the same strategy can't apply here. Without the tremendous market drive, it will be difficult for the color market to explode."

The biggest barrier is price. QMS's color laser, for example, may cost as much as $40,000—hardly an impulse buy. Said Zong Luo, vice president of research and development at Mannesmann Tally: "While the color printout is always in demand, our general feeling is that the user won't pay more than a 15 percent premium over the price of the monochrome."

Whether the technology exists is not the problem. "The problem," said one QMS spokesman, "is making it affordable—making a cost-effective print engine."

The challenge lies in mastering one of two current approaches to color laser printing. The first is running each sheet of paper through three distinct color developer units—for yellow, cyan, and magenta—in one machine. "Keeping the paper aligned as it goes through three times is not an easy task," said Loeber.

The other method uses revolving drums to apply color to a stationary piece of paper. This process has yet to overcome such logistical hurdles as enormous memory demands.

"People have this romantic notion about color laser printers, but right now it just doesn't seem the way to go," said Arnie Peters, marketing manager of Canon USA's printer division. "They're big and bulky. They're slow." To make a safe return on investment, in fact, Canon, QMS, and other companies perfecting the technology are more actively pursuing the color photocopier market.

"We're looking at the copier side for a comparison," said Larry Heltsley, Kyocera Unison's vice president of marketing. "If the new color copiers do very well in comparison to the black-and-white, then chances are greater that the market is ready for color laser printers."

In the meantime, the first color lasers may be too costly for all but a few users in corporate advertising and architectural engineering. For others in need of color printouts, ink jet and thermal transfer may be the way to go for a few more years.—**Edward L. Perratore**

Edward L. Perratore is a staff editor of PC Magazine.

spray liquid ink, of about the viscosity you'd use for a fountain pen, onto the printed medium.

Both makers' machines use four colors of ink—black, magenta, cyan, and yellow—and combine the last three on the medium to create a secondary spectrum of violet/blue, green, and red/orange. Black gets special treatment because typical print jobs require more of it than of any of the other hues. Hewlett-Packard uses a separate ink cartridge for black; Tektronix gives black double the number of nozzles used for other colors.

Thermal-wax printers are a new breed altogether. Instead of spraying ink onto paper like ink jets or pounding it on like impact printers, they weld it into place. Instead of hammers or nozzles, the thermal-wax printhead consists of a great number of tiny heating elements. The ink, a pigment mixed in a hard wax base, is bound to a thin plastic sheet. The medium to be printed upon is pressed against the ink, which, in turn, is pressed against the thermal printhead. When one of the tiny elements heats up, it melts the wax and causes it to stick to the paper.

One problem with this technique is that the heated element in the printhead must have time to cool off before it reaches the next dot position, or else it might accidentally release an extra dot of ink. Were the thermal head to skitter back and forth in typical dot matrix printer fashion, output would come slowly indeed. These thermal-wax printers, consequently, are all line printers. The printhead stretches all the way across the width of the paper.

Besides speed, another benefit of the line printer design is that the printhead does not need to move; the paper is merely pulled past it. This helps eliminate registration problems and makes the printing mechanisms less complex.

What is a problem, though, is getting the ink in place. It must be available at every point along the printhead simultaneously, and the next line of ink must be ready in very short order. As a result, all of these thermal-wax printers use peculiar ribbons—they're fully as wide as a sheet of paper. Instead of being one continuous color, they are segmented into sequences of blocks of color—for instance, yellow-magenta-cyan-black. Opaque marks on the transparent inksheet aid the system in knowing the position of the colors in relation to the printhead.

Some systems use four-color ribbons; others three (sans black). By laying colors over one another, these printers can achieve the same seven-color spectrum of the ink jets: yellow, magenta, red, green, cyan, blue/violet, and black. Black may either be a separate color or be made by combining all three primary ink colors. In addition, many thermal-wax printers allow the use of all-black inksheets-cum-ribbons for monochromatic printouts.

Both ink jet and thermal-wax printer technologies can increase the number of colors they print on paper by dithering. Instead of breaking the image into individual dots, they use small blocks of dots such as a two-by-two group of four. Each dot of the group can be made a different color; at a distance the foursome blend together into the equivalent of one giant spot of color—much like the color pixels seen in a television image—to form one homogeneous hue.

Taken collectively, these machines aren't going to change the pace of color in computer printing. At their premium prices and with their specialized purposes, they won't likely become mass-market merchandise. But like the first bulky televisions of the 1950s, they are likely the first taste of what's to come, harbingers of multi-hued printouts for everyman. Seeing their bright colors, you can catch a glimpse of the future. Here's what it looks like.

FACT FILE

CalComp PlotMaster
CalComp Corp.
2411 W. La Palma Ave
Anaheim, CA 92801
(714) 821-2000
List Price: $4,995
In Short: A thermal-wax printer with multiple compatibility modes—including plotter and Epson MX-80 emulation—capable of making slow but colorful images with 203.2- by 200-dpi resolution on A- and A4-sized cut-sheet paper or film. Also usable as a text printer.

CIRCLE 646 ON READER SERVICE CARD

CALCOMP CORP.

CalComp PlotMaster

Billed as a do-anything machine, the CalComp PlotMaster not only has the ability to make colorful raster images but also can swing double (or quadruple) duty—typing text, plotting charts, drawing object-oriented graphics, and mimicking an Epson MX-80. Far from being master of none of its trades, CalComp Corp.'s $4,995 thermal-wax-process PlotMaster produces some of the best pictures of all the machines in its price range, with on-paper resolution of 203.2 dots per inch horizontal by 200 vertical. Its seven-color palette, drawn from three ink colors, can be stretched to a nearly-unlimited number of shades through dithering.

Its disadvantages are twofold: the PlotMaster was the slowest of all machines evaluated in making the standard test chart, and its paper handling is limited to two sizes—A (8½ by 11 inches) and A4 (210 by 297 millimeters)—and two media, cut-sheet paper and transparency film.

The machine that makes these miracles is rather odd-looking, sort of like a modem sculptor's white plastic dream of a frog, complete with a large, square tongue sticking out. The hunched appearance of the 12- by 16½- by 19½-inch (HWD) case results from the unusual sheet-feeding mechanism that has been grafted atop the PlotMaster. The tongue is the output paper tray; it extends the depth of the machine to 27½ inches. The PlotMaster is sturdily constructed, with a cast aluminum chassis hiding inside its plastic case.

You can load up to 100 cut sheets of paper or 40 sheets of transparency film into the convenient tray located at the top rear of the machine. This tray seals up to prevent dust and other foreign matter from collecting. The medium is pulled from the stack, is guided by rollers down the front of the machine (inside a smoked-plastic shroud), and then makes a U-turn into the front of the PlotMaster. There it is grabbed by a metal gripper that runs the length of the PlotMaster's 3¼-inch rubber platen.

The paper is held in place by the gripper as the platen spins around once for each ink color to be printed, always turning in the

The CalComp PlotMaster creates some of the highest-quality images with clear, concise colors and superior dithered shading. Its text printing, however, does not match that of the laser printers, and its paper handling is limited to two sizes.

same direction to prevent registration problems. Finally, the completed sheet crawls out into the tray in front. For the standard test image, this entire journey required 338 seconds—that's over 5 minutes.

Text-mode printing is somewhat quicker because the paper needs to take only one good turn around the platen. Nevertheless, the PlotMaster's throughput rates below that of most ordinary dot matrix printers. (To print text, you'll also want to load the PlotMaster with a monochrome ribbon—good for 500 pages—to avoid wasting colored ink.)

Loading the wide, inked sheet ribbons is simply a matter of sliding in a cartridge through a door on the right side of the PlotMaster. But you've got to be careful—the ribbon-locking level is spring-loaded and vicious, fully capable of damaging fingers. PlotMaster cartridges are available loaded with inksheets but may also be reloaded using loose ribbon spools. Even reloading is a simple operation—just wrap the flimsy plastic sheets around the outside of the cartridge. The PlotMaster's three-color ribbons will need replacement after every 145 copies.

OK TEXT, GREAT COLOR As a text engine, the PlotMaster is actually unremarkable. Although its characters, formed from a 16- by 24-dot matrix, look sharp, their quality level rates at least a notch below the output of laser printers, and they are much more tedious to produce, taking six times as long. The standard typeface is a sans serif font available in three pitches (10, 12, and 16.5 characters per inch) and three line spacings (6, 8, and 10 lines per inch). In addition, you can select expanded, condensed, double-strike, emphasized, superscript, and subscript character attributes using standard Epson control sequences. While you won't be ashamed of the text the PlotMaster prints, you won't want to rely on it for heavy-duty word processing output.

Color output is the greatest redeeming virtue of the PlotMaster. The colors are bright and clear and dithered shading is smooth and even. For the page size, the image size is general and is nicely proportioned at the familiar 8- by 10-inch size.

The PlotMaster recognizes the PCI instructions used by CalComp 1040/1040GT plotters, a command set commonly used by CAD applications. Its object-oriented graphics mode is compatible with the GSS/VDI interface through drivers. But of course, the standards used by the PlotMaster are mostly of interest to programmers. What may be more important to you is that the multimodes mean lots of software support—over 100 applications, according to CalComp. Taking advantage of its Epson MX-80 (monochrome) compatibility lets the PlotMaster work with nearly the entire universe of IBM-compatible programs.

Front-panel user controls are minimal—two push buttons at the right of the front panel. One button toggles the PlotMaster between its plotter-compatibility and object-oriented/raster/text mode. The other ejects a sheet of paper, ending the current print job and clearing the buffer memory. Four LEDs—Wait, Load, Ready, and Alert—monitor operating parameters. In addition, over 1.5MB of buffer memory is standard equipment.

While other thermal-wax printers are sharper and nearly all are faster, the PlotMaster is the most compatible. Choose it for versatility—one machine for all your hard-copy needs.

●

HEWLETT-PACKARD CO.

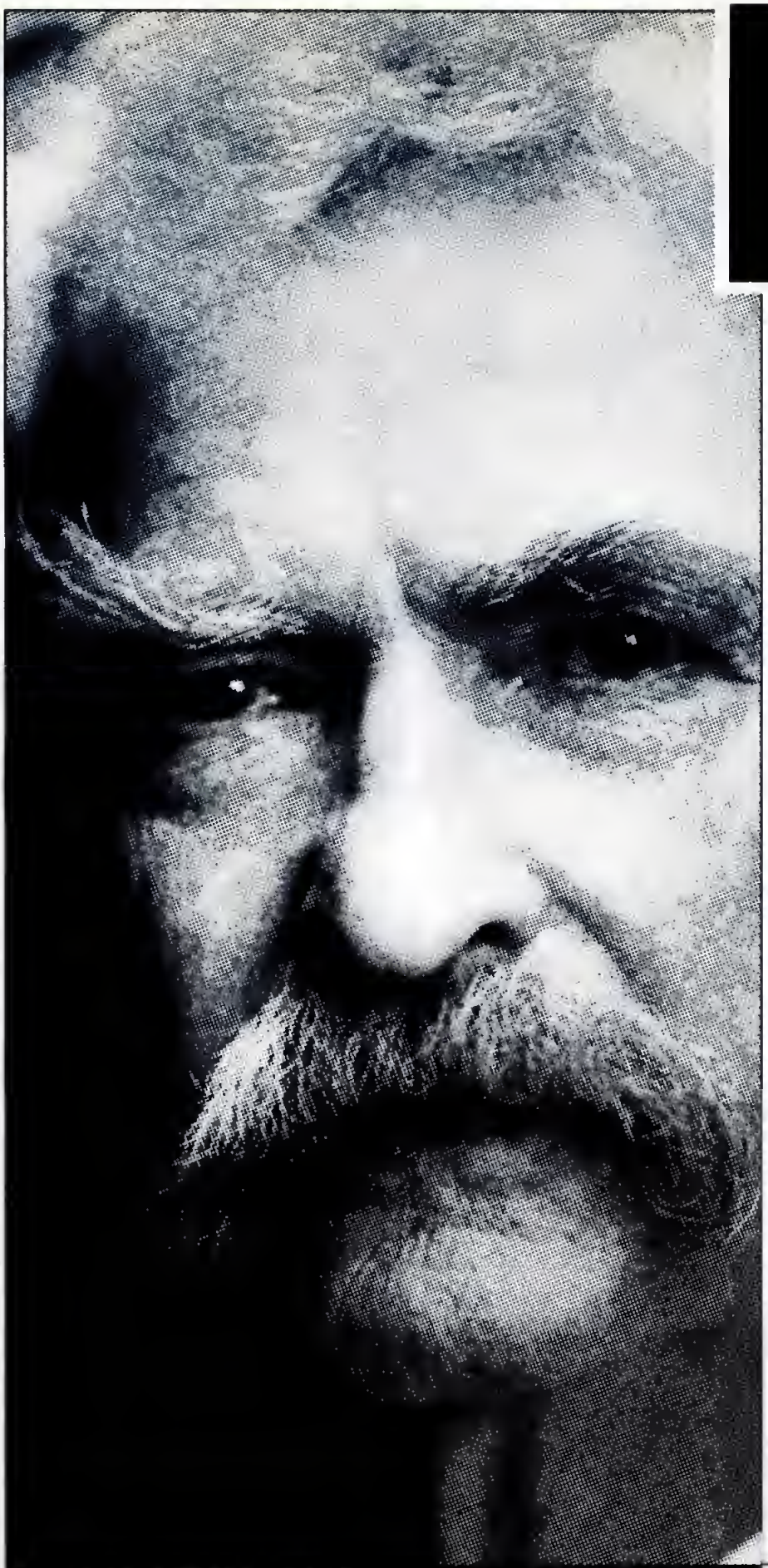
HP PaintJet

Diminutive in both size and price, Hewlett-Packard Co.'s PaintJet proved a compelling color printer. Although at the bottom of the scale of these high-end machines, its $1,595 price still puts it in premium printer territory.

Based on ink jet technology, the HP PaintJet has a palette of seven colors with on-paper resolution of 180 dots per inch. By using four dots per pixel and sacrificing resolution for 2 by 2 dithering, the PaintJet can generate 330 different dot patterns at 90 dpi. Its on-paper colors are bright, and shading was rendered more smoothly than that generated by the Tektronix 4696, the other ink jet machine reviewed here.

But the PaintJet's performance matches

Photographs: Thom O'Connor



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CIRCLE 218 ON READER SERVICE CARD

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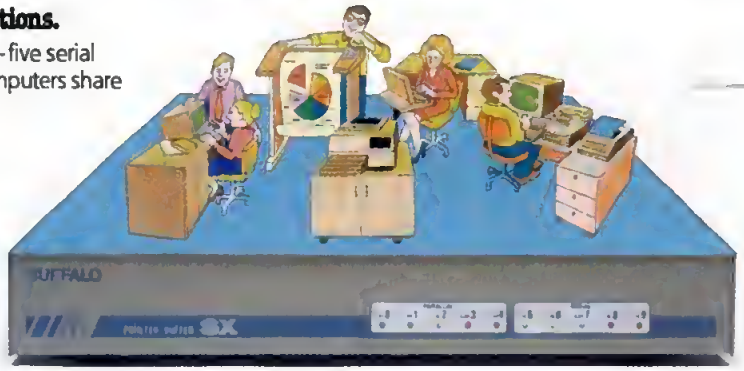

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CIRCLE 299 ON READER SERVICE CARD

The HP PaintJet is a well-designed and relatively low-cost printer that tested better than many of its more-expensive competitors. The PaintJet can produce 330 dot patterns at 90 dots per inch and provides bright colors with precise shading.

its relatively low price for a high-quality color printer. It took about 211 seconds for the PC Labs performance test full-page graphic printout, giving it a rank of second slowest overall.

The PaintJet is one of the few of these color printers that might successfully be used for ordinary text output. It produces dark characters that, because of the 15 by 30 matrix it uses, look substantially better than those of a nine-wire impact printer like the Epson MX-80.

The printer offers 15 fonts/character sets (mostly foreign languages), built-in and accessible by software command. It supports three text pitches (10, 12, and 18 characters per inch), three preset line spacings (6, 8, and 9 per inch), bold and underline attributes, and downloadable characters. Its 8K buffer is reduced to 512 bytes when downloading is used.

Even in text mode, however, print speed proved somewhat disappointing. Instead of the 167 characters per second promised by Hewlett-Packard, the PaintJet delivered throughput of only 61 cps on the PC Labs performance test letter—an acceptable, albeit slow, rate.

Small (just 3¾ by 17 by 11¾ inches, HWD) and squarely styled, the PaintJet resembles an inexpensive dot matrix printer. Even its big (2½- by 3⅜- by 4¼-inch) external power transformer recalls bargain basement designs.

The PaintJet is well made, however, and well thought out. Its few controls and connections, for instance, are fitted to the top of a square recessed area in the right-rear corner of the case. The power and standard parallel port connectors are also located there, as well as the bank of eight configuration DIP switches.

In parallel configuration only two switches are used, to set paper size and default character set. Serial and HP-IB communications settings, for printers equipped with those ports, are also made here.

In front of them, on top of the PaintJet, are its user controls, all small membrane switches. These include power-on and -off, set top-of-form, line feed, and form feed. In combination these switches also initiate the PaintJet's self-test and change-media-type settings (paper or transparency). Green LEDs indicate power-on and errors.

FOOLPROOF CARTRIDGES A lot of thought evidently has gone into the ink cartridge system of the PaintJet. The cartridges themselves are double-sealed in both plastic and aluminum containers. Before they are loaded into the printer, the oddly shaped cartridges must first be purged, using a special pump built into the PaintJet and hidden under a trapdoor on top of the case. Next, ink must be wiped from the cartridge nozzles—using a special medium hidden under another trapdoor, which also gives access to the printhead. Finally, the cartridges are snapped into the printhead and latched securely in place. Even on the first try, we didn't spill a drop.

The PaintJet uses two cartridges—one three-color (magenta, cyan, and yellow) and one loaded solely with black. They are coded to ensure proper installation.

The ink is sprayed on paper through 30 nozzles for black ink and ten for each of the three other colors. The primary ink colors (magenta, cyan, and yellow) blend on the paper to create the secondary colors (red, green, and blue).

According to Hewlett-Packard, a black cartridge will make about 1,100 text pages, a color cartridge about 180 pages of graphics. These capacities may vary widely with the type of output you make.

Unlike most traveling-carriage printers, the PaintJet does not allow access to the

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

HP PaintJet
Hewlett-Packard Co.
1820 Embarcadero Rd.
Palo Alto, CA 94303
(619) 592-8068
List Price: $1,595
In Short: A compact, easy-to-install ink jet printer that's equally adept at four-color and text work on pin-feed or cut-sheet paper or film with a resolution of 180 dpi. The most affordable among these high-quality color printers.

CIRCLE 645 ON READER SERVICE CARD

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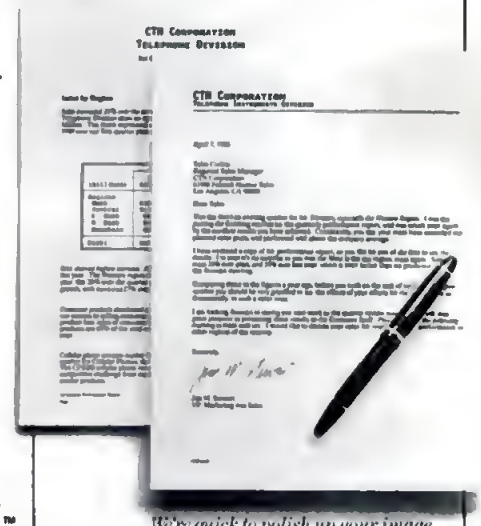

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Performance Tests: Color Printers

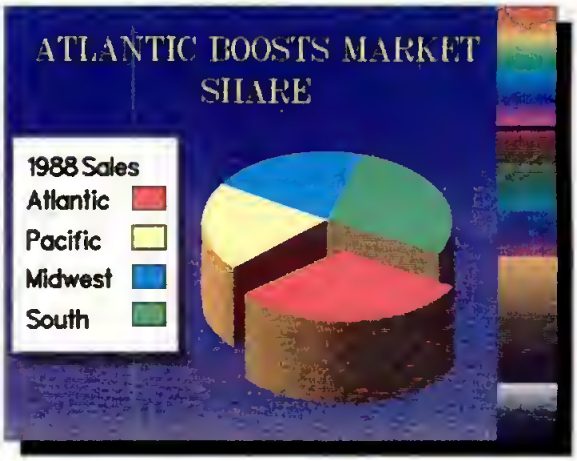
(Times given in minutes and seconds)

The Shinko CHC-335 was the fastest of these printers. Second and third were the Mitsubishi G650 and the Tektronix 4693D. The Tektronix has the best-quality output and can also manage up to four PC hosts simultaneously. Its 4MB to 12MB buffer minimizes the time your PC will be tied up loading images into it.

Although slow, the HP PaintJet produces good images at a price that makes it an attractive choice. Finally, the CalComp PlotMaster makes up for its slowness with good-quality output and a wide array of compatibility modes.

CalComp PlotMaster 5:38

HP PaintJet 3:31



Seiko TargaPlot 2 2:50

Shinko CHC-335 1:59

The **Color Pattern** performance test processed and printed a color test image file that was created with the AT&T *TIPS* software by PC Labs. The file was loaded from disk to the screen. The tests were then timed from the exact moment that the print cycle started until the moment the printout was complete and form-fed out of the printer. Each test was timed in whole seconds. The tests were run three times, and an average time was recorded.

In order to test color nonimpact printers in the most efficient way possible, PC Labs used Truevision's Targa 16 board for color image processing, along with AT&T's *TIPS* software. These were installed in an IBM PC AT with a 30MB hard disk drive, 512K of base memory, an Intel Above Board with 1MB of memory installed (of which only 128K was used to backfill DOS to 640K), and an EGA board. Alongside a NEC MultiSync monitor was a Sony Trinitron monitor for the color imaging processing system. A Microsoft serial mouse was used as a pointing device. All printers were run parallel from the primary parallel port of the IBM serial/parallel adapter.

Mitsubishi G500 **3:08**

Mitsubishi G650 **2:21**

Tektronix 4693D **2:35**

Tektronix 4696 **3:05**

Performance Tests: Color Printers

The color comparison table below presents the color bars from the **Color Pattern** performance test samples, reproduced at their original size. Printer drivers for the Mitsubishi G650 and Tektronix 4693D, written specifically by the manufacturers to run in the AT&T *TIPS* environment, set up unique aspect ratios, alignment, and image resolutions to provide the best output possible. As a result, the two printers output, respectively, condensed and expanded test samples.

CalComp PlotMaster

HP PaintJet

Mitsubishi G500

Mitsubishi G650

Seiko TargaPlot 2

Shinko CHC-335

Tektronix 4693D

Tektronix 4696

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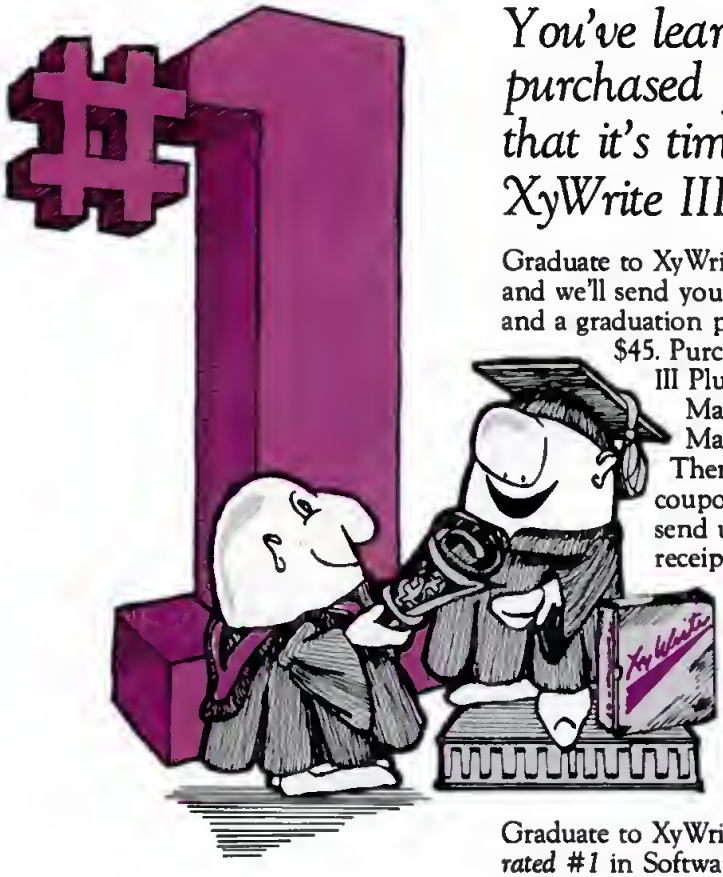

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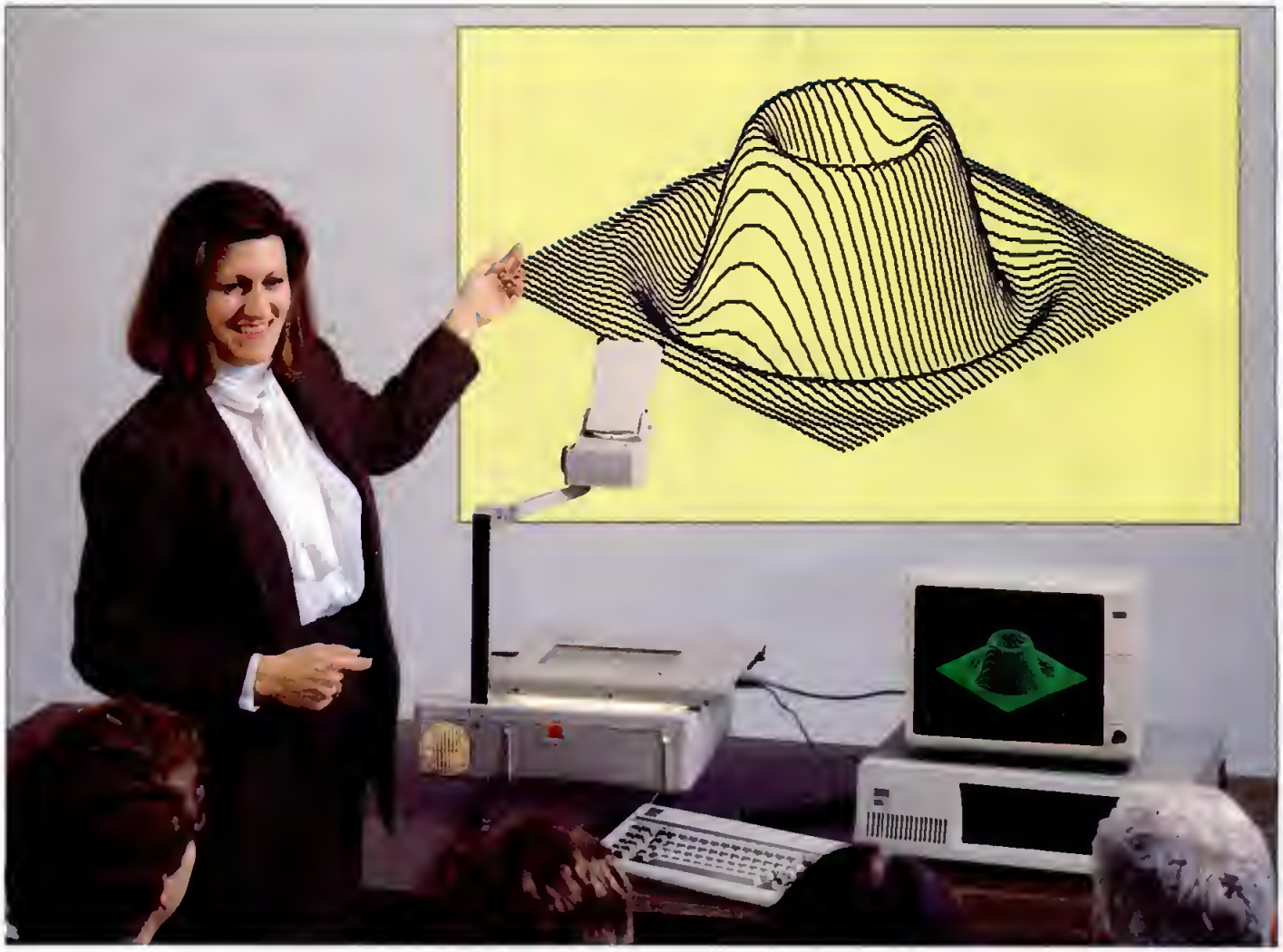

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PC Magazine

CIRCLE 195 ON READER SERVICE CARD

"ViewFrame's display is impressive. ...(It) was sharp and clear, even when we moved the projector across the room, enlarging the display to 10 feet by 14 feet."

Tom Bigley, InfoWorld

PC MAGAZINE **Editor's Choice**

printhead chamber. Normally, even the narrow slot that allows paper to emerge is covered by a width of clear plastic that's attached to the bail arm.

The printhead naturally migrates to its resting place under the access door whenever the PaintJet is busy, and it is constantly held there electrically. Only a severe shove made it lose its place, and it immediately returned when the printer was reset by turning it off and back on again. In operation, the PaintJet works like an ordinary serial-impact printer, scanning text one line of characters at a time and drawing graphics in swaths of similar width. All colors are laid down in a single pass.

The carriage of the PaintJet is designed to handle continuous-form paper of the standard 9½-inch width (8½ inches wide after the edge perforations are removed). Best results require special coated paper to prevent the thin ink from being absorbed too quickly and blurring.

The PaintJet uses a pin-feed mechanism, that is, sprockets at either edge of its rubber platen. The right sprocket is adjustable through a narrow range to handle paper that might vary a bit from its nominal width. Single sheets and specially treated acetate are also accommodated. Two paper lengths, 11 inches (English) and 12 inches (European), can be used. Changing between them requires setting a DIP switch.

The PaintJet proved easy to set up—just about plug-and-play—and easy to use. It also succeeds reasonably well as a dual-mode machine. Overall, it may be the best bargain in a top-quality color printer.

The Mitsubishi G500 is a physically ungainly machine with awkward qualities. Although the 240-dot-per-inch resolution creates sharp images, dithered and secondary colors are murky. The paper-feed mechanism is cumbersome and accommodates a limited range of paper sizes.

MITSUBISHI ELECTRONICS AMERICA INC.

Mitsubishi G500

Even as color printers go, thermal-wax machines are decidedly odd. And among them, the $4,700 Mitsubishi G500, from Mitsubishi Electronics America, is unusual enough to leave even Rube Goldberg mystified. From its peculiar paper sizes to its mysterious paper mechanism, the G500 blazes its own trail through the morass of color output.

Even at first glance the G500 is a unique machine. Its white and gray-beige case, measuring 9½ by 17½ by 17½ inches (HWD) and weighing about 40 pounds, looks like an ordinary printer with a plastic prism grafted on top. Rising still higher above that is a wire rack for displaying its output.

The prism covers the hole through which the G500's fanfold paper enters. After wrapping around one side of a bidirectional tractor, this paper makes a quick U-turn around a thin, 1-inch-diameter rubber platen, then slips through the other half of the tractor on its way out.

Gaining access to the paper-feed mechanism means lifting the traplike lid of the machine, which is hinged in the rear and, because it is very heavy, is supported by locking arms and lowered under the restraint of a pneumatic arm. Before you lift the lid, however, you must feed the paper into the rear of the prism, then raise the roof and pull the paper the rest of its way. Although confusing, the ritual is easily mastered.

Unusual, too, is the G500's paper sensor, a metal arm cleaved to the rear of the case like a genetic defect. You must thread the paper under this strange assembly so that the G500 knows that it's there.

Also unusual is the small black mark printed on each sheet to let the G500 register each sheet properly. Without this mark in the right place on the paper—you load

PC MAGAZINE FACT FILE

Mitsubishi G500
Mitsubishi Electronics America Inc.
991 Knox St.
Torrance, CA 90503
(213) 515-3993
List Price: $4,700
In Short: An odd, comparatively slow thermal-wax printer that uses either 8-, 11-, or 12- by 12-inch proprietary tractor-feed paper with an on-paper resolution of 240 dpi.

CIRCLE 644 ON READER SERVICE CARD

MAKE ME A CYCOPY . . .

"Here, make me a cycopy of this."

Sound strange? So did "Xerox this" before that company's trademark first fell into the mud of everyday office vocabulary. But if Mead Imaging of Miamisburg, Ohio, has its way, such terms as "cylith" and "cycopy" will soon become just as familiar.

Mead has developed a new color reproduction technology that uses a specially treated film to create high-resolution images at low cost. Called Cycolor, the process offers new alternatives for computer printers, slide printers, and other applications.

"Cycolor is a cross between digital and analog technology," said Paul F. Nezi, vice president of marketing and sales at Mead. "You see in the image not dots but bursts of color—it's a continuous-tone process."

Cycolor begins with a film coated with millions of microcapsules called cyliths, each of which is sensitive to red, green, or blue light. Measuring about one-tenth the diameter of a human hair, they contain a dye of either cyan, magenta, or yellow.

To reproduce a red image, for instance, light reflected off the image is directed onto the film. Magenta and yellow dyes—but not cyan—must be allowed out of their cyliths and combined to form red. Therefore, the red light effects a hardening of those cyliths containing cyan so that when the exposed film is later pressed in rollers against the treated paper or transparency, only those cyliths harboring magenta and yellow dyes will burst and transfer their contents to the paper. Subsequent heating, and a reaction with the paper's special resin coating, enhances the quality of the color.

"Depending upon the color's intensity and the duration of exposure, the cyliths will harden in degrees," explained Nezi, "releasing the specific amounts of dye required to match the color of the original."

Beyond the cost of a printer that accepts data instead of a hard-copy image, the long-term expense of special film and paper would seem to place Cycolor in the same ballpark as other processes considered expensive by a cost-conscious market. Mead insists this is not so. While cost-per-page figures are not being released, Nezi estimated Cycolor as costing little more than photo color processing—and less than electrophotography.

Several manufacturers have begun producing devices using Mead's Cycolor process and materials. Noritsu America Corp. has introdueed a computer-generated slide printer. And Greyhawk Systems is counting on Mead's process for its plans to design a more-cost-effective color printer than those available.

—Edward L. Perratore

the wrong paper, say, or the correct paper upside down—the G500 will thoughtlessly fast-forward through an entire ream without pause.

Obviously, this is paper to be procured from the manufacturer, which offers it in lengths of 8, 11, and 12 inches, but only in a 12-inch width. In the sample that accompanied the machine, the tractor-feed edges were not perforated for removal.

The paper's odd size might seem to allow for generous images, but in reality it doesn't. The maximum image size for the 12- by 11-inch sheets is a mere 8½ by 9 inches. Transparency film is not offered.

EASY RIBBON LOADING Loading the three-color inksheet ribbon is a simple chore that is complicated by the need to unthread the paper before you begin. Once you lift the lid and pivot the tractor/platen mechanism out of the way, you can easily lay the inksheet upon its near-straight path. The only complication is getting it under the photosensor that registers each color.

Colors are printed one at a time, so the paper rolls back and forth through the mechanism at least three times to achieve its nominal seven-color spectrum. Dithering broadens that considerably, to an unspecified number of grainy shades.

The resolution of the printhead is 240 dots per inch, which allows for admirably sharp images. In the test image, however, secondary and dithered colors proved noticeably uneven, particularly the large area of shaded dither.

The output speed of the G500 proved remarkable, too, for its slowness. Its performance on the test image fell in between that of the two ink jet printers at over 3 minutes (188 seconds) per page.

Membrane switches are provided as user controls along the belt line at the front of the machine. In addition, a seven-segment LED and isolated LED indicators show many of its settings. Besides the expected form feed/line feed and on-line buttons, there are an enlarge button and margin and intensity controls.

The machine itself is sturdily built, with the plastic case covering a steel subchassis. The tractor and inksheet take-up are powered by cogged rubber belts. The platen is driven by a blue plastic gear, which Mitsubishi warns is vulnerable to improper loading. The top is interlocked, bringing printing to a stop when lifted.

The standard interface is an IBM-compatible parallel port at the left rear of the machine. At the other rear comer is the power switch and cord.

Since its output is hardly remarkable, its speed slow, and its mechanism like an outcast from a crackpot inventors convention, the G500 would be a choice only for application software that strictly demands it. Better alternatives are available.

●

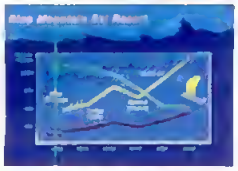
MITSUBISHI ELECTRONICS AMERICA INC.

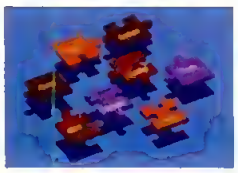
Mitsubishi G650

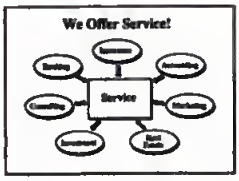
If you want big images, you need a big printer. And that's exactly what Mitsubishi Electronics America's massive G650 delivers. The 80-pound-plus, 9½- by 20½- by 19½-inch monster printer churns out colorful sheets up to 11 by 17 inches. But the big printer makes little dots—300 of them per inch—which means high quality, exactly what you'd expect from an $8,900 hunk of hardware.

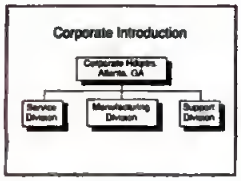
The rakishly styled G650 looks like a second-generation laser printer, a flattened

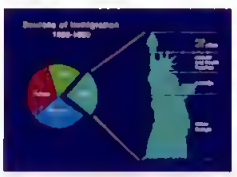
Of all the graphics you can create with Freelance Plus,

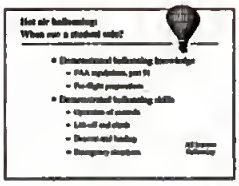


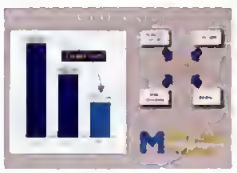


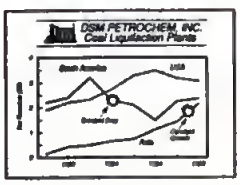


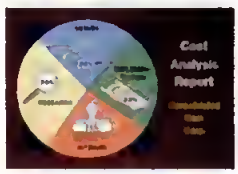


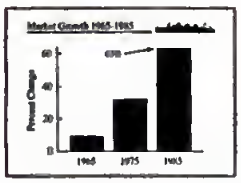












The Mitsubishi G650 is a big machine that cranks out big, beautiful pictures with a superior 300-dot-per-inch resolution. This printer weighs in at about 80 pounds and can create high-quality sheets as large as 11 by 17 inches.

box with the top dropping into a gentle forward slope. The only unusual features are its paper-feed and output trays, which lean up and back from the top of the machine. These trays add another 10 inches to the printer's height and an inch or two to its depth.

One advantage won by the unusual-looking scheme is that you don't need access to either side of the printer—so it will fit in tighter confines. It also simplifies the paper and inksheet handling inside the machine.

The G650 works exclusively with cut-sheet paper and transparency material in any of four sizes—ANSI A (8½ by 11 inches), B (11 by 17 inches), ISO A3 (297 by 420 millimeters), and A4 (210 by 297 millimeters). Maximum image size is 10.66 by 14.91 inches on B paper.

In operation, paper is pulled from the rear feed tray until it vanishes inside the G650. In the case of the PC Labs test image, the disappearance lasted 141 seconds (the second quickest of these color printers); then the clean, color-bedecked paper quietly crawled into the output tray.

The mysteries of this process are unlocked by fingering a latch on the right side of the case. The G650 then opens like a clamshell, revealing half its mechanism below, half above. It's a mass of rollers, gears, and cogged rubber belts, all built upon a solid-steel subchassis nestled inside the plastic case. A pneumatic piston prevents the heavy lid from crashing down on your hand.

As with most sheet-feeding mechanisms, the workings of the G650 are beyond the understanding of mortals. The print mechanism is, however, amazingly simple—just the wide bar of the no-moving-parts thermal printhead cutting midway across the chassis.

Threading the inksheet ribbon into the G650 is simplified by its cassette mechanism. You load the wide ribbon into the cassette outside of the printer—simply a matter of stretching the sheet straight from the supply to the take-up spool. You then slide the cassette into a tray connected to an articulated arm that retracts into the bowels of the machine and finishes threading the ribbon. The complex scheme actually simplifies the chore.

A narrow strip running the width of the printer's front holds its user controls: an array of membrane switches and LEDs. The switches allow you to select three degrees of image enlargement, three degrees of image intensity, paper feeding, and on/off-line. The LEDs light up to indicate various error conditions and the status of the controls.

■ The Mitsubishi G650 is quick and offers the largest images of the machines that were examined.

The cable connector of the standard-equipment parallel port lies at the bottom of the rear panel; the power connector and power switch are directly above it. A bank of eight DIP switches is adjacent to the port connector, only one of which performs a useful function (selecting ANSI or ISO paper sizes).

Overall, the on paper quality of the G650 is very good. The machine is quick and offers the largest images of the machines examined here. Other color print-

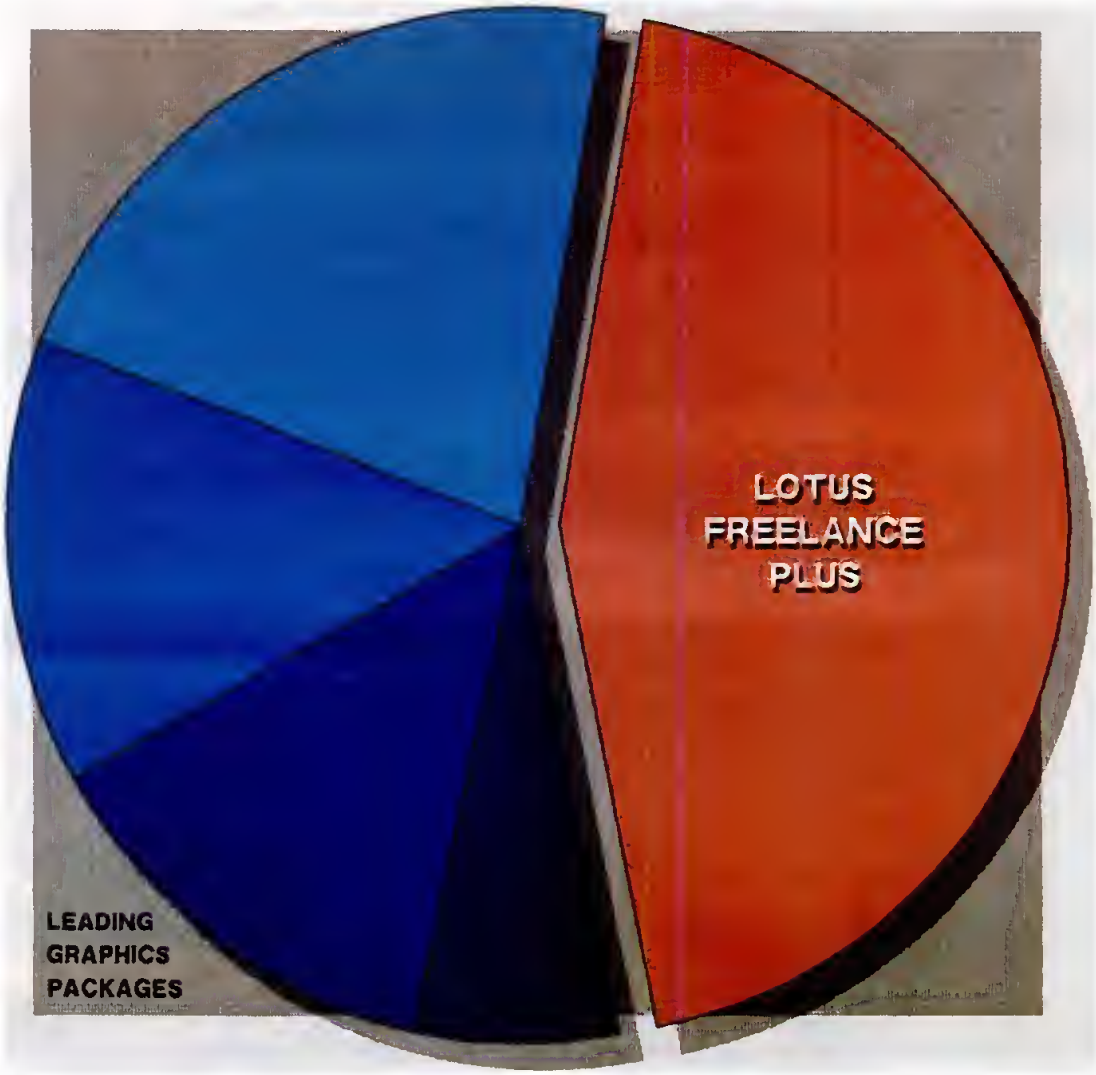
PC MAGAZINE

FACT FILE

Mitsubishi G650
Mitsubishi Electronics America Inc.
991 Knox St.
Torrance, CA 90503
(213) 515-3993
List Price: $8,900
In Short: A big, expensive thermal-wax printer that makes big images—up to 11 by 17 inches—quickly on sheet-fed paper or transparency film with laser-quality resolution of 300 dpi.

CIRCLE 643 ON READER SERVICE CARD

This is the one we're particularly proud of.



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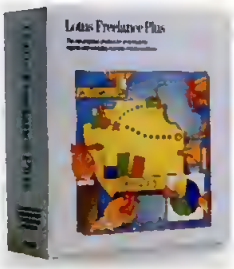

*Based on national audits conducted by Audits & Surveys, Inc., May–December 1987.

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ers, however, produce superior images at a lower price. Although the G650 really has no weaknesses, other machines are better buys.

●

MITSUBISHI INTERNATIONAL

Shinko CHC-335

Although the Shinko CHC-335 looks like a conventional dot matrix printer that grew up, the output of this $4,500 thermal-wax printer puts it into another league entirely. Marketed by Mitsubishi International, it's the raciest thermal-wax color printer around, the only one capable of painting the whole standard test image in just under 2 minutes.

On-paper quality suffers somewhat from that speed. The 8-dot-per-millimeter (203.2-dot-per-inch) printhead of the CHC-335 gives everything—and particularly anything green—a viewed-through-a-screen-door look. (The CHC-335's near-twin, the CHC-235, has a coarser-still 6-dot-per-millimeter printhead.) While its palette is limited to seven solid colors—yellow, magenta, red, green, cyan, blue, and black—dithering fills in all the shades in between quite smoothly.

The CHC-335's resemblance to conventional printers is rooted in the off-white plastic case, essentially a flat box measuring 6½ by 15½ by 16 inches (HWD) with a slight slope to the front third of its top. A central smoked-plastic rectangle covers the area that would normally be the printhead chamber.

The printhead of the CHC-335 stretches all the way across the center of the machine's case, however, and is rigidly fixed in place. Its wide inksheet stretches across it, running in a nearly direct path between feed and take-up rollers.

Access to this mechanism is gained by lifting a lid that gouges a gaping mouth out of the front and top of the case. About half the mechanism is mounted in this lift-up portion of the case, including the entirety of the paper-handling machinery. A latch holds up this weighty lid, and a pneumatic cylinder prevents it from chomping down on lingering fingers.

Perforated-edge roll paper mounts on brackets at the rear of the CHC-335. The paper is pulled from the 10-inch-wide roll by a pin-feed mechanism that slides it down around a rubber platen. This platen, about 1 inch in diameter, forces the paper against the inksheet and printhead. Afterward the paper resurfaces, runs across a paper cutter, and completes its journey back to the rear of the machine. In addition to push-button controls for paper movement, a recessed knob helps to position paper by mechanically spinning the pin-feed and associated mechanism.

Paper length—the length fed from the roll for each image—can be set to 8, 11, or 12 inches. The proprietary plain paper is 8.7 (not 8½) inches wide, once stripped of its perforations. The nominal printing area is 8.3 by 9.5 or 10.5 inches for 11- or 12-inch forms, respectively. The test image actually measured 7.9 by 10.25 inches.

IN-AND-OUT ACTION During printing, paper travel seems to be a give-and-take operation. The printed sheet emerges once each time a color is printed, then gets retracted back through the machine. After one, three, or four passes (depending on print mode), it finally emerges once and for all.

Three types of inksheet transfer media

Mitsubishi's Shinko CHC-335 was the fastest machine tested, with the ability to reproduce the entire standard test image in less than 2 minutes. The on-paper quality was comparable to that of the ink jet printers, but the high speed compensates for the average resolution.

PC MAGAZINE

FACT FILE

Shinko CHC-335
Mitsubishi International
701 Westchester Ave.
White Plains, NY 10604
(914) 997-4999
List Price: $4,500
In Short: A fast and reasonably compact thermal-wax printer that offers 203.2-dpi resolution on 10-inch-wide sprocket-fed roll paper that trims to 8.7 inches wide in lengths of 8, 11, or 12 inches.

CIRCLE 641 ON READER SERVICE CARD

Every presenter wants to make a compelling, persuasive case. And color, you'll agree, makes all the difference. It's more eye-catching. More readily understood. More memorable. In short, color makes any desktop presentation more effective. And research proves it.

All you need is a Hewlett-Packard ColorPro Plotter like we used here, or the HP PaintJet Color Graphics Printer. Together with a PC—IBM compatible or Apple Macintosh—you can use all the popular graphics software like Lotus Freelance Plus, Cricket Presents, HP's Graphics Gallery (used below), Microsoft Chart and Harvard Graphics.

At under $1,300, the HP ColorPro Plotter may be just where you want to start. It will turn your ideas into colorful, easy-to-grasp visuals. Or, if you need to combine near-letter quality text with color graphics, you can rely on the HP PaintJet Color Graphics Printer for under $1,400. Whichever you choose, you'll create desktop presentations with startling color and greater impact.

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CIRCLE 340 ON READER SERVICE CARD

HEWLETT PACKARD

Guess which presentation made the sale.

are available from Mitsubishi for the CHC-335: black, three-color (magenta, cyan, and yellow), and four-color (three colors plus black). All arrive as loose rolls that need only be stretched across their relatively straight path.

The only difficulty encountered with the test machine was the instruction to use the core of a spent transfer roll as the take-up spool. The new machine had no spent roll, and no take-up roll was provided by Shinko. The parts list of the machine lacks a cardboard core for this purpose—it shouldn't.

A small control panel to the left of the machine includes three membrane switches and four indicators. Select switches the CHC-335 on- and off-line, T.O.F. advances the paper to the next sheet, and O.H.P. switches the printer between its overhead-projector-film and paper modes. The four LEDs indicate power, on-line, overhead-projector-film mode, and out-of-paper. The on/off rocker switch is conveniently located a few inches behind the control panel.

But in front of the panel is a small plastic door that covers two banks of DIP switches controlling the CHC-335's more-intimate operating parameters. Among other things, these switches select color or monochrome printing mode, depth of color, normal or reverse printing, paper size,

■ The image generated by the CHC-335 has more-saturated colors than that of the ink jets.

and character-mode handling. Although adjusting DIP switches is an inconvenient way to make adjustments, most of the changes are rather esoteric, the kind you won't want to tamper with very often. The standard CHC-335 interface is a parallel port at the rear of the machine.

Although the on-paper resolution of the image generated by the CHC-335 falls into roughly the same class as that of the ink jets, its colors are more saturated and it is faster. If you demand your printouts quickly and have an empty take-up roll around, the Shinko CHC-335 may be just what you're looking for.

SEIKO INSTRUMENTS

Seiko TargaPlot 2

The name tells the story of Seiko Instruments' TargaPlot 2: above all, it's designed to take the images made with a Targa board and plot them on paper. But rather than a plotter, it's a thermal-wax color line printer that offers moderately high resolution—240 dots per inch—and a seven-color palette that can be dithered into a rainbow.

As a desktop companion, the 73-pound, 12½- by 17¾- by 20-inch (HWD) TargaPlot looks like a photocopier with one exception: there's no place to put paper in. A gaping hole near the bottom of the front allows paper to slide out, but there's no complementary entrance point.

The TargaPlot doesn't make its own paper. Rather, it operates on paper rolls that you load inside along with the waxed ink-sheets. It uses special 8½-inch-wide non-perforated roll paper that the machine slices off into individual sheets (a standard 11 inches long) immediately after printing. (Pressing a combination of buttons on the control panel will also advance the paper roll the length of a sheet and cut it off.) Roll-style film is also available for making transparencies.

Lift a long green latch above the inset control panel, and the whole top of the TargaPlot pivots up. Inside you'll see the sturdy mechanism. Arranged around a gracefully curving cast-and-machined-aluminum chassis you'll see more rollers and gears than in a wringer washing machine—all aimed at moving paper and ink-sheets through the TargaPlot.

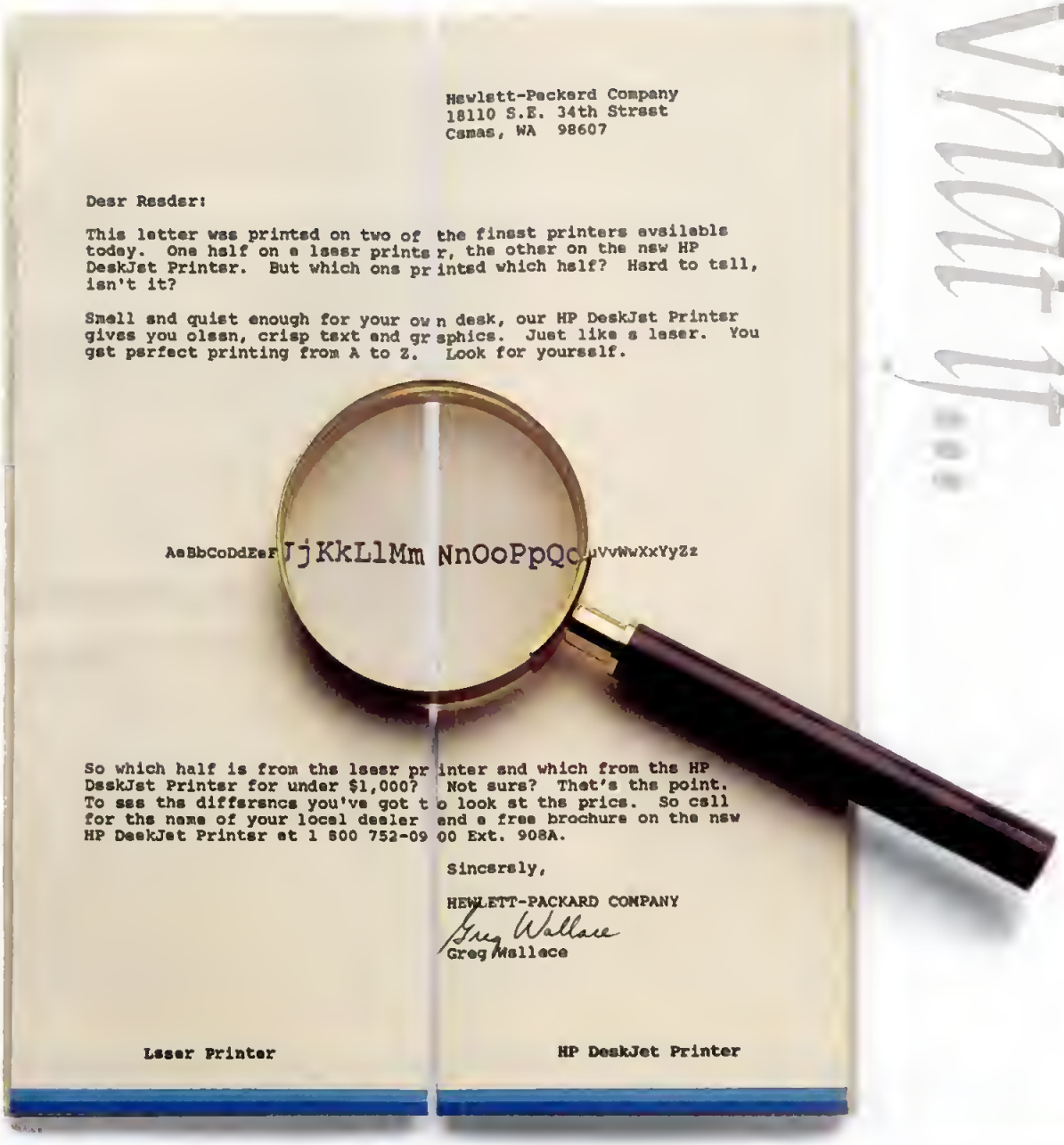
The printhead is attached to the top cover of the TargaPlot. Since nothing in the cover moves, registration is not a problem even if the top and bottom halves of the case do not align perfectly.

Roll paper is pulled through the TargaPlot by a drive capstan and pressure roller that directs the continuous sheet down and through the output slot. The capstan drive system allows paper to travel both forward and backward without slippage when mak-

The Seiko TargaPlot 2 provides easy installation and start-up with resulting clear images. The shading is effective, and the 240 dots per inch allow a fairly high resolution with a large array of color combinations.

we never stop asking "What if"

If you can see the difference, you must be looking at the price.



The New HP DeskJet Printer. Laser-Quality Output for Under $1000.

HEWLETT PACKARD

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CIRCLE 339 ON READER SERVICE CARD

ing the three printhead passes required by color printing.

The whole process of sending paper on its journey and printing the standard color test sample required 170 seconds, putting the TargaPlot almost exactly in the middle of this pack of printers.

When loading the TargaPlot, the paper goes in first because the inksheet feed roll covers it up. You pull several inches off the roll and thread it through the capstan system. Inksheets install on the special gear-driven spindles supplied by Seiko, which are then latched into the drive mechanism. The wide inksheets roll from the rear of the machine to the front take-up spool across a perfectly flat path.

Both inksheets and paper rolls produce about 200 copies each, so you shouldn't have to pull out the ink to reload the paper. Transparencies are another matter, because film rolls hold 120 image sheets.

The TargaPlot plugs into a standard parallel port through a connector at the right rear of the machine. The power connector is at left rear; the power switch is nearby.

The control panel, which is given its own angled niche in the front of the machine, shows you a variety of LED indicators, a two-digit, seven-segment character display used primarily for counting copies, and a number of push-button controls, all membrane switches. Included among the indicators are general-machine, paper-out, and ink-out error lights and a ready light. There are ten switches for digits one through zero and ones for clear, reverse, test, on-line, and start/enter.

As you might guess, the TargaPlot is entirely programmable using these push buttons. But the only major function that's documented for them is making multiple copies off-line using an image stored in the TargaPlot's internal buffer.

CONTROL PROGRAM All other control is given over to a program, TMenu, that you run on the hard-disk-equipped computer you have plugged into the TargaPlot. This program gives you menu-driven control over the intensity of color, the diffusion of color (similar to saturation), the type of dither used for shading, the anti-aliasing method used in image expansion, and the number of copies to be printed.

■ Instead of taking direct output from a program, the TargaPlot prints .TGA files, made with a Targa board, which are saved on-disk.

Instead of taking direct output from a program (which the TargaPlot does not happily accept), you print .TGA files, made with a Targa board, which are saved on-disk. The TMenu program analyzes the files and sends the proper codes and commands to the TargaPlot.

The image quality produced by the TargaPlot proved quite good; shading was smooth, all the way from intense color to light dither. Colors, however, did not seem as bright as those of some other thermal-wax printers, in that the ink let more of the paper substrate show through.

The TargaPlot 2 is actually part of a family of machines. The TargaPlot 1 is similar but lacks the refined control panel. The larger TargaPlot 3 tackles bigger images using 11- by 17-inch paper with 203-dpi resolution but takes twice as long to print.

The single-purpose design of the TargaPlot 2 results in its easy installation and start-up, plus a near-guarantee of good images from your Targa-based system. If your needs go beyond that, however, you should consider other printers.

PC MAGAZINE FACT FILE

Seiko TargaPlot 2
Seiko Instruments
1130 Ringwood Ct.
San Jose, CA 95131
(408) 943-9100
List Price: $5,995
In Short: A thermal-wax printer designed primarily for use with a Targa board. Produces its images on 8½- by 11- or 12-inch paper or film cut from rolls with a resolution of 240 dpi.

CIRCLE 642 ON READER SERVICE CARD

●

TEKTRONIX INC.

Tektronix 4693D

One look and you'll know the Tektronix 4693D is a heavy-duty workhorse. If its hulking size—13 by 21½ by 21½ inches (HWD)—and 90-pound weight aren't enough to convince you, the four parallel inputs on the rear panel will. This $7,995 machine is more than a match for the output of a single PC, and it can deftly coordinate the print chores of a small work group.

Based on a thermal-wax print engine, the 4693D can achieve on-paper resolution of 300 dots per inch, the same as most laser printers. The 4693D is much more colorful, however, able to print in seven primary colors melted from its four-color (black, blue, magenta, and yellow) inksheet. (The color total is eight if you count the hue of the paper background, as does Tektronix.) Dithering extends the palette of the 4693D to about 16.7 million colors or 256 shades of gray.

Both landscape and portrait image orientations are possible on either domestic standard letter- and legal-size or the metric A4 size of paper or film. The 4693D uses a laser printer/photocopier-style paper-feeding mechanism for cut sheets only. The input tray, which slides into the right side of the mechanism, holds up to 100 sheets of

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

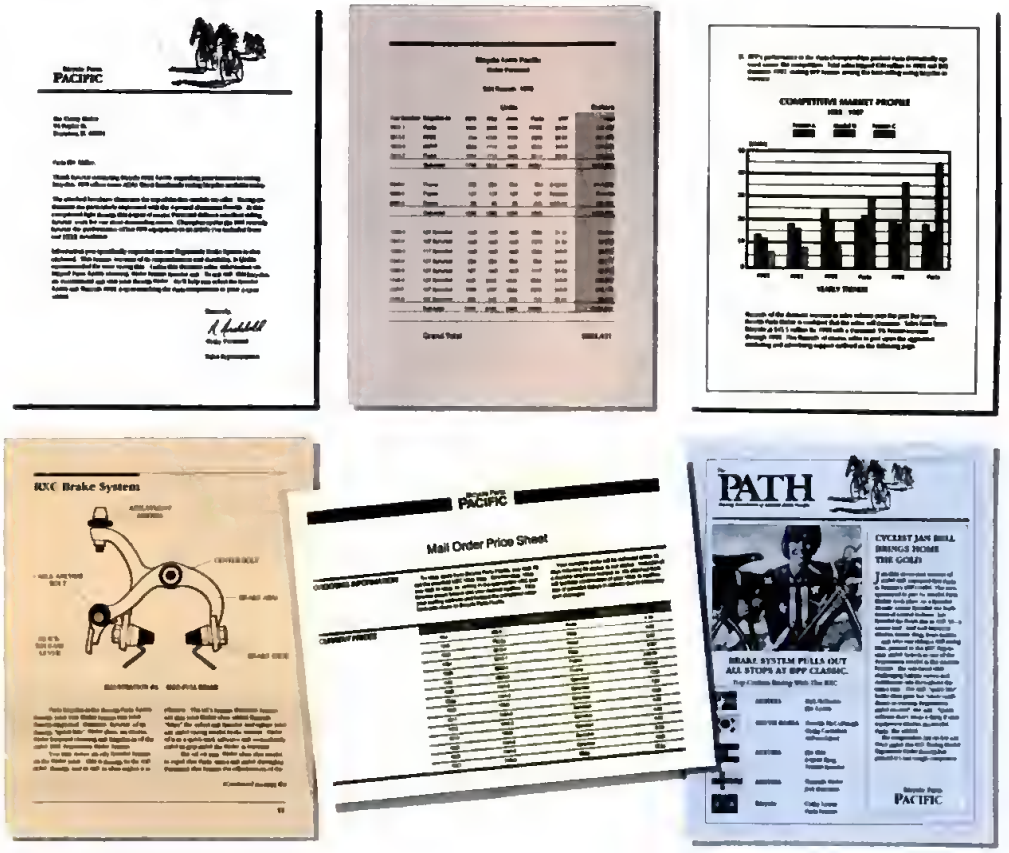
Tektronix 4693D
Tektronix Inc.
P.O. Box 1000
Wilsonville, OR 97070
(503) 627-7111
List Price: $7,995
In Short: A big thermal-wax printer that produces top-quality (300-dpi resolution) images on cut-sheet paper, with the ability to simultaneously serve four ATs using a 4MB internal buffer that's expandable to 12MB.

CIRCLE 639 ON READER SERVICE CARD

we never stop asking

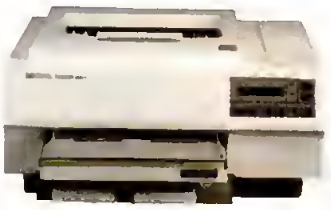
What if...

How to look good from start...



to finish.

The HP LaserJet Series II Printer.



Nothing brings your ideas to life like the HP LaserJet Series II Printer—from office memos to forms to newsletters. As the leading laser printer, it works with all popular PCs and PC software packages. And, with a wide range of fonts, you get more options to create superior looking documents.

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HEWLETT PACKARD

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Print samples were created using Microsoft Word, Microsoft Excel, and Aldus PageMaker.

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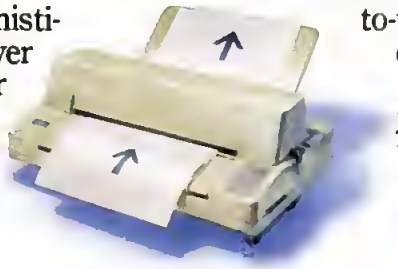

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CIRCLE 242 ON READER SERVICE CARD

The Tektronix 4693D has an on-paper resolution of 300 dots per inch and a color palette that offers a large array of vivid hues. Although it is a big machine with a great volume capacity, the 4693D also produces one of the highest-quality resolutions available.

paper or 50 sheets of acetate film. Output slides out onto another tray beneath the media input.

A drop-down front cover allows access to the knobs and gears that control paper travel, all easy to see in their bright green finish against the otherwise drab mechanical interior decor.

■ The on-paper quality of the Tektronix 4693D was unmatched. Resolution proved excellent, shading nearly perfectly uniform.

The thermal-wax inksheets are supplied in roll form, but you can install them easily on a wraparound carrier that slides out of the left side of the printer on a full-suspension carriage. Loading the inksheets requires dropping the feed roll into two end-supported slots, pulling the sheet around the transfer roll cassette, and taping it to the take-up spool.

A COMPUTER IN ITSELF Complete control of the 4693D is afforded through five push buttons and a 40-column by two-row LCD on the angled front panel of the case. This control panel reveals the 4693D to be a computer in itself, one that uses a completely menu-driven setup procedure. Pressing various buttons steps you through a 13-entry menu system that allows selection of such parameters as media type, graphics mode, color palette, image size and orientation, color corrections, communication parameters, and tests.

With this push-button control you can, among other things, fine-tune colors or switch to monochrome imaging, invert black and white, and choose whether pixels are interpolated or replicated when images are enlarged.

The 4693D automatically mediates contention among its four input ports. Although it gives you some control over its parallel communication parameters, the choices are somewhat limited—either to the Tektronix standard or to that used by IBM—amounting to little more than a choice of input termination.

Although the 4693D can be made to work without one, use of a Targa board is highly recommended. Otherwise, the raster-based printer requires special drivers to work with specific software packages. The 4693D is also compatible with Sun and Apollo workstations equipped with the IKON interface board.

According to Tektronix, a full-page image—which requires about 4MB of data—can be transferred into the 4693D in less than 3 seconds. That time obviously must apply to pictures created by one of those exotic workstations, because an IBM parallel port cannot transfer data anywhere near that fast.

Because the 4693D must hold an entire image in its internal memory during printing, 4MB is the minimum standard RAM with which the machine can be equipped. Options allow expanding internal RAM to 12MB. In such a configuration, Tektronix claims the 4693D can deal with all four inputs in real time.

When connected to an AT, the 4693D required substantially longer to print an image than the 1-minute time quoted by Tektronix—just over 2½ minutes (155 seconds) for the standard test chart. Nevertheless, that rate qualifies the 4693D as one of the faster machines, third in overall ranking of those evaluated here.

On the positive side, the on-paper quality of the 4693D was unmatched. Resolution proved excellent. Shading was nearly perfectly uniform; colors were bright, saturated, and clear.

Although its volume capabilities and construction—which may prove as enduring as Roman battlements—might seem to mark the 4693D as overkill for plugging into a single-user PC, its laser-quality-in-color earns it a rating as the costs-be-damned best machine in this survey.

●

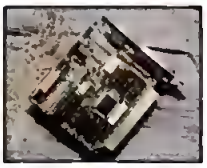
TEKTRONIX INC.

Tektronix 4696

Although its greenish beige case strongly resembles a conventional dot matrix impact printer, the Tektronix 4696 is a very different machine, indeed. The four-color ink jet engine is best at graphics and only tips its hat at type.

The 4696 is unusual to operate, too. The machine knows better than you about the persnickety demands of its inking system. Switch it off, for instance, and the

What's Everyone Humming About?



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Color Printers: Summary of Features

(Products listed in ascending price order)

	PC HP PaintJet $1,595	Tektronix 4696 $1,795	Shinko CHC-335 $4,500	Mitsubishi G500 $4,700	CalComp PlotMaster $4,995	Seiko TargaPlot 2 $5,995	PC Tektronix 4693D $7,995	Mitsubishi G650 $8,900
Printing method	Thermel ink jet	Ink jet	Thermal transfer	Thermal transfer	Thermal transter	Thermal transfer	Thermal transfer	Thermel transfer
Resolution (dote per inch)	180	240	200	240	200	240	300	300
Internet buffer eize	8K	No buffer	No buffer	2 lines	1.5MB	2.5MB	4MB	2 lines
COLORS								
Without dithering	7	7	7	7	7	7	7	7
With dithering	330	125	270,000	Depends on software	Several thousand	15,625	16.7 million	Depends on softwere
MEDIA								
Paper	8½ by 11 inches; z-told, cut-sheet	8½ by 11 inches; coated	10 by 12 inches; perfo-rated tractor feed	8 by 11 inches; untreated	8½ by 11 inches; ther-mal transter	8½ by 11, 11 by 17 inches; calendared	8½ by 11, 8½ by 14 inches; coated	Sizes A, B; untreeted
Film	8½ by 11 inches	Film not supported	10 by 12 inches; overhead	Sizes A, B; standard transparency	8½ by 11 inches; ther-mal transfer	8½ by 11, 11 by 17 inches	Film not supported	Sizes A, B; standard transparency
Interfecee	Centronics perellel	Centronics parallel	Centronics parellel	Centronics parellel	Centronics seriel	Centronics parallel	Centronics 4692, 46930 parellel	Centronics perallel

PC —Indicates Editor's Choice

4696 doesn't immediately die, but bumps and grinds along for nearly a minute, wiping its nozzles and purging ink from any place where it might dry and clog the mechanism.

Subvert the process by pulling the plug, and you'll suffer the consequences. Ink jets become ink sputters, and portions of text and graphic images disappear. Running a 5-minute, manually initiated purge cycle clears the mechanism, but you may need to repeat the process several times to get everything flowing. (After an improper shutdown and an idle weekend, the evaluation 4696 required 14 purge cycles to clean everything up.)

Tektronix does nothing to hide the fluid nature of the ink the 4696 uses. Each color of the low-viscosity ink is supplied in an individual syringelike pod that is used to fill one of the four well-like ink reservoirs in the printhead. To load the ink, the pointed end of the pod is plunged into the well, keyed so that only a pod of the proper color fits into each well; then a cap on the rear of the cartridge is inverted and a sharp projection in it pierces the end of the pod. Gravity then draws the ink into the well.

WATCH YOUR FINGERS You have to be careful when you extract the pod, lest you cover your fingers with the fast-drying and quite permanent ink. Occasionally, you'll also have to replace a squarish black plastic maintenance cartridge through a door in the lower-left corner of the printer's front end. The cartridge, which contains deionized, distilled water used to clean the print mechanism, simply slides into place.

The 4696 printhead operates conventionally, riding on two steel tubes that allow no accuracy-robbing looseness or play. It squirts the ink for each of its three bright colors to the paper through four nozzles, while eight nozzles are used to spray black ink and give it extra intensity. Since text characters are generated from a 12 by

■ The Tektronix 4696 printhead operates conventionally, riding on two steel tubes that allow no accuracy-robbing looseness or play.

FACT FILE

Tektronix 4696
Tektronix Inc.
P.O. Box 1000
Wilsonville, OR 97070
(503) 627-7111
List Price: $1,795
In Short: An ink jet printer that thinks it's smarter than you when running complex maintenance cycles. Produces mediocre images with 120-dpi resolution on cut-sheet or roll paper or film, using e conventional pressure-feed mechanism. Text abilities are only vestigial.

CIRCLE 640 ON READER SERVICE CARD

With a resolution of only 120 dots per inch, the Tektronix 4696 creates images using three intensities to produce a high-quality graphics output. The densest of these intensities doubles each dot to provide the darkest black of any ink jet printer tested.

PC MAGAZINE EDITOR'S CHOICE

- **HP PaintJet**
- **Tektronix 4693D**

Choosing the best nonimpact color printer depends upon your application; your choice is limited to the list of machines that will function with the software and hardware you have. You need a Targa board, for instance, to take advantage of the Seiko TargaPlot 2, and special drivers to use most of the other thermal-wax machines.

That said, we award honors to the HP PaintJet because it's relatively cheap and not so choosy. It's easy to use and widely supported, and it can do double-duty as a text printer. Although its resolution is only moderate, it generates bright, clear, colorful images.

At the opposite end of the spectrum, the Tektronix 4693D puts the best color on paper of all the machines tested. Although its price is staggering, it can serve a whole work group at once. Just be sure your software will support it.

to matrix and the print mechanism operates bidirectionally, each row of text requires two complete back-and-forth passes.

The 4696 has three built-in character sets, only one of which is text—a very plain font that yields 10 characters per inch horizontally and 6 lines per inch vertically. Although the only print enhancement available is underlining, the 4696 does allow you to download your own fonts.

While graphics resolution does not vary from 120 dots per inch, the 4696 paints its images with three intensities. The densest of these, which effectively doubles every dot, produces the darkest black available from any ink jet printer we've encountered.

The three ink colors—cyan, magenta, and yellow—combine on paper to make red, green, and a bluish violet. Those colors, together with black, give the 4696 its full spectrum of seven hues, which can be broadened substantially by dithering.

The 4696 mechanism is sturdily built. The 6¼- by 20- by 13½-inch (HWD) case covers a stamped steel chassis. The hinged cover over the printhead chamber is interlocked, so lifting it causes the 4696 to stop immediately. After lowering it again—even after physically moving the printhead—the 4696 picks up exactly where it left off without a trace of evidence of your transgressions on paper. The printhead, driven by a cogged rubber belt, locks securely in place at the left side of the chamber when the 4696 is not active. A clear plastic window in this cover allows you to view the output of the 4696 about 1 inch past the printhead.

Paper is fed through the 4696 using a conventional pressure mechanism. A knob extends from the 1¾-inch-diameter rubber platen outside the right side of the case. The 4696 handles both cut sheets and rolls of paper or transparency media that have been specially treated.

The most-often-used controls of the 4696 are located on a small panel on the right side of its beveled front edge. Three square push-button switches allow you to select the medium (paper or transparency), feed in paper, and switch the 4696 on- or off-line. Status indicators for each of the four ink colors and three indicators for the switches complete the front panel.

Switches to begin the purge process and the self-test are located in a recessed area of the rear panel. Also located there are an alignment adjustment, the parallel input connector, a power connector, and a bank of four DIP switches for setup. The power switch is on the left side of the case.

Choose the 4696 for its graphics abilities, or if you have other Tektronix equipment and want to keep everything in the family. For an ink jet, it produces good quality graphics with an intense black. On the down side, its text abilities are only vestigial, and its self-preening may prove bothersome to people used to demand-free dot matrix impact printers. PC

Winn L. Rosch is a contributing editor of PC Magazine.

Software Breakthrough: the RANDOM information processor

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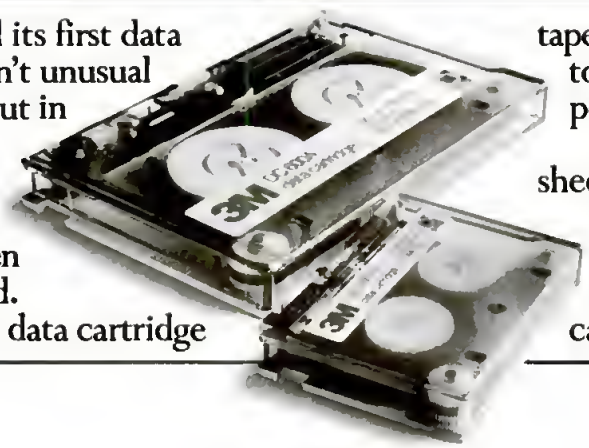

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■ MONITORS ■ FRANK BICAN

Breaking with tradition, the new VGA monitors use analog signals instead of digital. The advantages (greater brightness, sharper resolution, and 256 colors on-screen) are evident in these models from Compaq, Electrohome, IBM, Logitech, Relisys, Nanao, NEC, Magnavox, Princeton, Sony, and Tatung.

MAKING WAY FOR VGA

IBM and Compaq stopped producing EGA graphics boards in mid-February. You should need no clearer proof that VGA is here to stay. Although EGA boards and monitors will still be around for a while longer, it's a good time to start getting ready for the 256-color 640- by 480-pixel resolution that will become the norm for PC graphics—and the platform for even greater things in the future.

We've rounded up 15 of the latest all-purpose VGA-compatible monitors from Compaq, Electrohome, IBM, Logitech, Relisys, Nanao, NEC, Magnavox, Princeton, Sony, and Tatung. With street prices ranging from just over $400 to $1,100, these monitors, whose screen sizes run from 11 inches to 14 inches, aren't just great performers—they're affordable, too. (More expensive VGA monitors with bigger screen areas will be reviewed in future issues of *PC Magazine*.)

BREAKAWAY Introduced last year, the VGA standard breaks from IBM's earlier adapters by using an analog signal instead of a digital one (digital is also called TTL, for transistor-transistor logic). The circuitry in the VGA adapter takes direct control of the primary (red, green, and blue) color guns of the monitor, with rising signal voltages equating into directly proportional increases in the brightness of each. Consequently a VGA monitor can display as many as 256 colors (out of a palette of 262,144) on the screen at any one time, far exceeding the EGA's limit of 16 colors out of 64. In its highest-resolution graphics mode, the VGA displays a 640- by 480-pixel screen in 256 colors, versus the EGA's 640 by 350 by 16. (To get VGA colors, you drop to a CGA resolution level of 320 by 200.)

VGA's maximum resolution means sharper graphics. Text-mode applications

haven't been forgotten, either, with individual characters built within 16- by 9-pixel cells—even sharper than the Monochrome Display Adapter's 14- by 9-pixel characters. Maximum text-mode VGA resolution is 720 by 400 pixels.

Just as any text-based program that runs at CGA resolution will automatically run at EGA resolution on an EGA monitor, any text-based program will automatically sharpen up and fill the 9- by 16-character box provided by text-based VGA resolution. The process is a function of the display adapter, not the software.

Graphics-based programs are another matter. Software written to put up to 16 colors on the screen needs to be modified before it can take advantage of the 256-color potential of VGA. The latest versions of *AutoCAD*, *Boeing Graph*, *Dr. Halo*, *Microsoft Windows*, *PC Paintbrush*, and *Show Partner F/X* are among the programs that have already been upgraded, and many more are just over the horizon.

If all this isn't enough to get you interested in VGA display systems, you should know that the VGA adapter can be operated in no fewer than 17 different video modes and offers perfect emulation of the earlier CGA, MDA, and EGA boards as well. So you won't have to upgrade all software just because of a new video standard.

GLOSSARY OF TERMS

Some of the terms best used to describe monitors may be more familiar to photographers and TV repairmen than to computer users. Here are a few definitions:

Bandwidth indicates the range of frequencies that the video circuitry is capable of delivering to the picture tube, and it is one of the factors that determines image sharpness. A bandwidth of at least 25 MHz is considered acceptable in a VGA monitor.

Barrel distortion is the form of linear distortion in which horizontal and vertical lines, as they move progressively farther from the center of the screen, are bowed out at their centers, much as the staves of a barrel appear—hence the name.

Blooming is an increase in the deflection of the electron beams tracing across the screen, and it results in the enlargement of the image as the brightness level increases.

Dot pitch indicates the spacing of the three (red, green, and blue) phosphor dots that form a matrix over the display area. Dot pitch is measured in millimeters, and, in general, the smaller the dot pitch, the sharper and more fully formed the characters will appear.

Fringing is the appearance of stray colors along the edges of individual characters. Its appearance at all points on the screen indicates a misaligned electron gun, but when it only occurs along the edges of the screen, it is the result of one color gun having a higher degree of deflection than the other two.

Linear distortion is image distortion caused by misalignment of the color guns and other factors.

Persistence is the length of time that individual phosphor dots will luminesce after being excited by the electron beam. Long-persistence phosphors help reduce flickering of the image but also result in "ghost" images that linger on after an area should have reverted to black.

Pincushion distortion is a form of linear distortion in which lines that are drawn progressively closer to the edges of the screen tend to bow inwards at their centers.—**Frank Bican**

PRICE OF POWER This dazzling performance places tough demands on monitors, and your old composite-signal CGA display just won't cut the mustard. Even if it could be modified to handle the VGA's multiple signal lines, it would fall far short of the scanning frequencies and bandwidth required by VGA.

VGA increases the *horizontal scanning frequency* (the rate at which the electron beam sweeps from left to right across the screen) to 31.5 kHz, double the CGA's 15-kHz rate, and 50 percent higher than the EGA's 22-kHz sweep rate.

The *vertical scan frequency* (which is sometimes referred to as the *refresh* rate or *frame* rate) has been pushed to 70 Hz, as opposed to the 60-Hz rate of the CGA and EGA adapters, or the 50-Hz rate of the MDA board. At this rate, the entire screen is redrawn 70 times a second, allowing the use of shorter-persistence phosphors (minimizing ghost images) without introducing any screen flicker whatsoever.

Image sharpness also depends on the bandwidth of the monitor. The higher the bandwidth, the more quickly a color gun can be turned on and off as it traces horizontally along the screen. A bandwidth of only 15 MHz is adequate for the CGA adapter, while VGA requires at least 25 MHz to produce an acceptably sharp image. The monitors reviewed here all have bandwidths ranging from 25 MHz to 40 MHz, with little appreciable difference in sharpness.

Many of the monitors tested here are better referred to as *multiscanning* monitors, rather than just VGA monitors, because they can automatically adjust to the sync signals from a variety of video boards. Most can be used with the older CGA and EGA boards as well, and, because they support horizontal scan rates as high as 35 kHz, will probably work with future display adapters as well.

Besides coping with IBM's plethora of graphics boards, multiscanning also allows compatibility with other computers. Of the monitors reviewed here, all but Compaq's, IBM's, and the Princeton PSC-28 are compatible with Apple's Macintosh II as well as DOS machines.

CONSTANT VERTICALITY What multiscanning doesn't necessarily provide is constant image size along the vertical axis. As a VGA adapter switches among its various modes, it also varies the vertical sync frequency between 60 and 70 Hz. Consequently, a monitor that's correctly adjusted for operation in VGA (70 Hz) mode will display a somewhat "flattened" picture when operating in CGA-emulation mode. Automatic vertical size adjustment cures this malady, and the majority of monitors tested included this feature.

In the absence of such intuitive size-ad-

justment circuitry, you'll have to adjust image size and position manually. Perhaps in order to keep their monitors uncluttered and stylish, many manufacturers have hidden these knobs on the back or under top- or side-mounted doors (if they supply them at all). Sometimes you need to be a contortionist to adjust rear-mounted controls while staring at the front of the screen. The alternative is to enlist the aid of a friend, or at least a large mirror.

The physical dimensions of any monitor case (VGA or otherwise) are largely a matter of personal preference. In general, bigger displays are more legible, but some smaller units, like Princeton's UltraSync, use their smaller (0.28mm) dot pitch to good advantage in preserving legibility despite their size.

■ The Compaq Video Graphics Color Monitor is not only functionally superior to the IBM VGA offerings, but it's also significantly cheaper.

To test our assortment of VGA-compatible monitors, we settled on the definitive VGA display adapter by attaching each to IBM's PS/2 Model 80. Each one was then judged on color purity, clarity, resolution, linear distortion, glare, and convenience with such applications as the PC Labs benchmark tests, *Microsoft Windows/386*, and several standard text-based programs. Since speed is a factor of the video board rather than the monitor, speed tests weren't necessary.

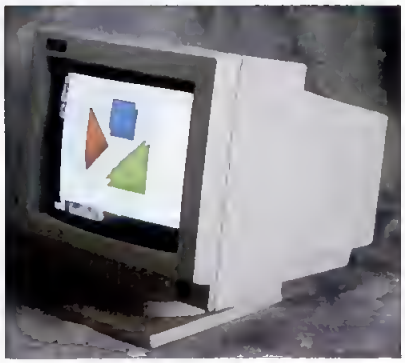
Our reviews were intended to point out the major differences between products, but the very nature of VGA monitors results in fairly subjective appraisals. Colors that seem drab to one viewer may look fine to another, so once you have narrowed down your choices, give them a careful look and try them with your main applications before laying out the cash.

COMPAQ COMPUTER CORP.
Compaq Video Graphics Color Monitor

Compaq must be the biggest thorn in IBM's side. Apple Computer may have been its first major competitor, but Apple's products have always followed a genetically distinct evolutionary path. Compaq, on the other hand, was the first and most successful to clone IBM's Mendelian maps. In some instances (such as with the Deskpro 386/20), the company's infusion of fresh DNA strands has resulted in a superior product. The tradition continues with Compaq's 13-inch Video Graphics Color Monitor. Not only is it functionally superior to any of the IBM VGA offerings, but at $699, it's also significantly cheaper.

As with most of the monitors we tested, the best image was obtained with the front-mounted contrast control set to maximum and the brightness level set to the middle of

With the Video Graphics Color Monitor, Compaq has once again created a product that surpasses IBM's in quality while retailing at a significantly lower price. The 13-inch Video Graphics Color Monitor produces clear-cut graphics and crisp, clean text characters; it has a maximum resolution of 640 by 480 pixels.



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CIRCLE 153 ON READER SERVICE CARD

its range. So adjusted, both text characters and graphics were gratifyingly sharp, and there was no blurring in the corners. Maximum resolution is 640 by 480 pixels.

For the most part colors are clean and accurate. Only the brown is less than perfect, having an orange cast to it. The borders between adjacent color bars, as seen in the PC Labs VGA benchmark tests, are only average in sharpness. This isn't enough to condemn the monitor, but there are other products available that don't suffer from this problem.

A small amount of pincushion linear distortion is visible along the left and right edges of the display. This, along with an average amount of image blooming, resulted in less-than-perfect performance with one of the *Windows* benchmark tests.

In another test (actually intended to test the speed of VGA boards), area fills gradually faded from one color to another on the screen. As the center of the screen slowly painted a predominantly black area, the sides of the image wavered inward somewhat from the area adjacent to the lighter-colored borders along the top and bottom. It really didn't hurt the otherwise legible *Windows* sessions, but it might be enough to make you think twice before using the Video Graphics Color Monitor for CAD/CAM work.

The Compaq's minimalist controls—brightness and contrast—are conveniently mounted on the front of the monitor. Although they'll do for most people (and their applications), our review sample could have benefited from controls for image size and position. The image occupied an area measuring only 11⅝ inches diagonally, and it was shifted slightly to the upper-left-hand corner of the screen.

The Compaq's case is compact for the 13-inch size of the screen. The tilt-and-swivel base operated with reasonable smoothness and offered a wide-enough range of motion to help eliminate glare from a screen that has an average level of shine.

Most of the monitors reviewed here have enclosures designed to conform with IBM's pale-gray system units. Compaq, on the other hand, favors beige for its products, and the Video Graphics Color Monitor is no exception. Consequently, it appears a bit out of place with some other hardware. But it looks great sitting on top of a Compaq computer, especially the speed-demon Deskpro 386/20, a system to which it is perfectly suited.

PC MAGAZINE FACT FILE

Compaq Video Graphics Color Monitor
Compaq Computer Corp.
2055 FM 149
Houston, TX 77070
(713) 370-0670
List Price: $699
Requires: VGA display adapter.
In Short: Graced with a crisp, bright 13-inch display, the Compaq is the perfect monitor for the Deskpro 386—and not a bad selection at all for other VGA-based systems.
CIRCLE 699 ON READER SERVICE CARD

ELECTROHOME (USA) INC.
Electrohome 1310U
Electrohome 1312U

This dynamic duo from Electrohome is a set of virtually identical twins, save for differences in screen characteristics. The $895 1310U is graced with a 13.3-inch etched screen and uses conventional short-persistence phosphor, while the 1312U (also $895) offers a polished screen and decidedly long-persistence phosphor. The 1312U is intended for people like CAD/CAM users who are most likely to be obsessed with squeezing out the last bit of sharpness. Both monitors have 910- by 645-pixel resolution.

Screen differences aside, both multiscanning Electrohome monitors produce images among the very best, and both have enough video connectors and controls to ensure compatibility with most any computer system made today.

The cabinet that Electrohome has chosen for these monitors looks particularly handsome when it is partnered with the IBM PS/2 Model 80 mounted alongside a desk. The pale-gray box is a perfect match for the IBM keyboard, and the darker-gray front bezel is the same color as the darker keycaps. Located along the lower edge of the bezel are the monitors' controls for brightness, contrast, and power.

PC MAGAZINE FACT FILE

Electrohome (USA) Inc.
1155 Milliken Ave., Suite F
Ontario, CA 91761
(714) 983-5660

Electrohome 1310U EDITOR'S CHOICE
List Price: $895
Requires: CGA, EGA, PGC, or VGA video adapter; optional video cable, $40.
In Short: Superb color rendition and razor-sharp clarity add up to an outstanding 13.3-inch multiscanning monitor. Toss in an etched screen and enough video connectors and controls for virtually every application, and the 1310U is an easy winner.
CIRCLE 684 ON READER SERVICE CARD

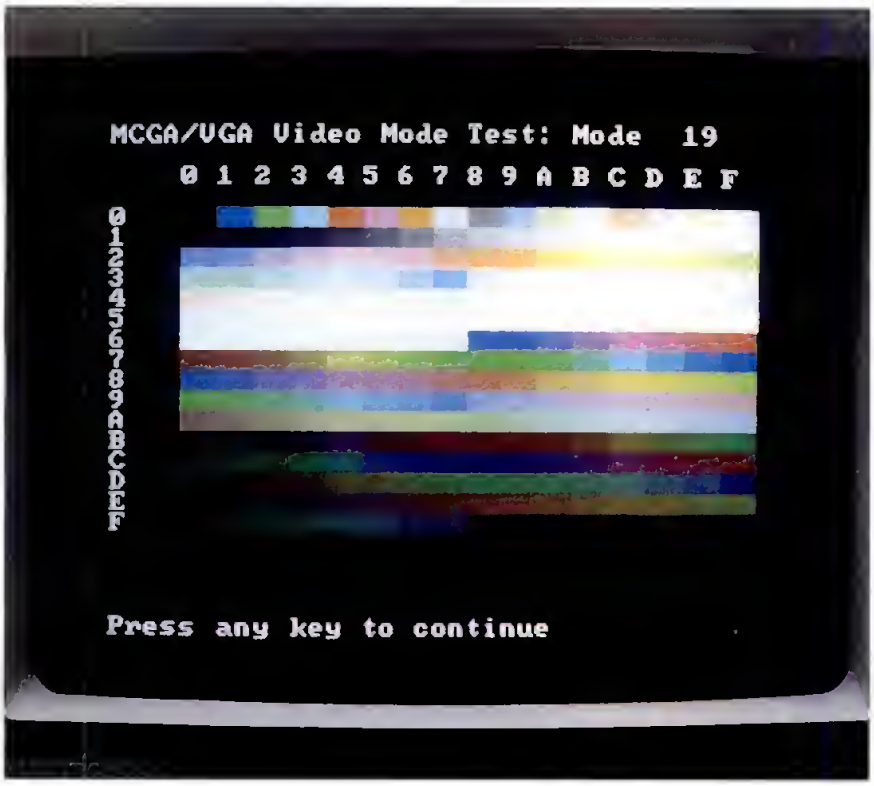
Electrohome 1312U
List Price: $895
Requires: CGA, EGA, PGC, or VGA video adapter; optional video cable, $40.
In Short: Although its other attributes match those of the 1310U, the polished screen and long-persistence phosphor of the 1312U are more of a nuisance than anything else. For the last iota of clarity, this is the monitor to have, but most will be better served by the 1310U.
CIRCLE 698 ON READER SERVICE CARD

The real fun starts when you move to the rear of either monitor, where you'll find a whopping total of 7 switches—8 image controls and (yikes!) 11 video connectors. They're fairly easy to figure out; just as well, since the skimpy two-page manual doesn't offer much help.

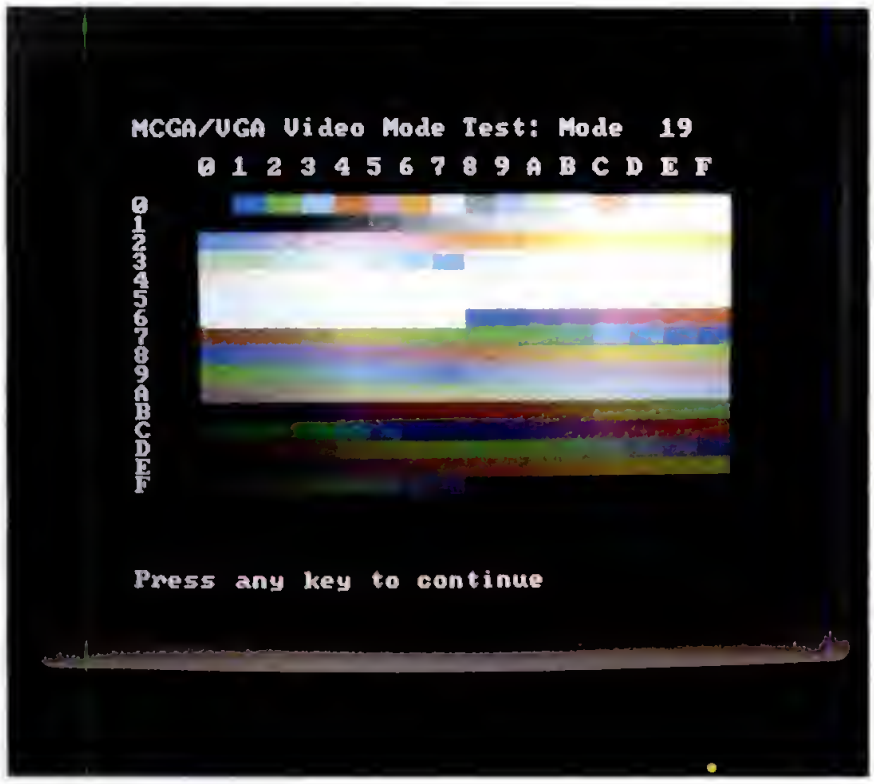
Two sets of potentiometers control vertical and horizontal size and position. One bank of four works when the signal input switch is set for the DB-9 TTL input connector (as would be used with CGA or EGA boards). The second set comes into use when the switch is in its analog position (for VGA adapters).

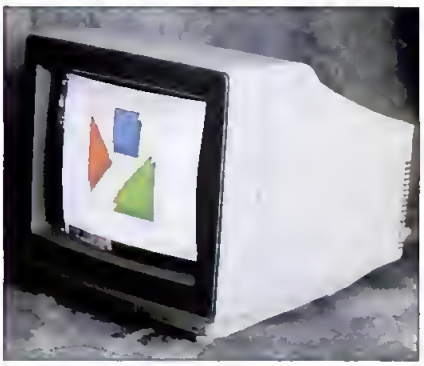
In analog mode, the signal is fed in by five BNC video connectors, each carrying separate signals for the blue, red, and green color guns, and vertical and horizontal synchronization signals. As you might expect, this requires an optional ($40) video cable to connect to the 15-pin output of the VGA adapter.

But that's not all. There are also five video outputs, each with its own switch for a 75-ohm impedance terminator. In nor-



The Electrohome 1310U has a 13.3-inch etched screen and operates with a short-persistence phosphor. This monitor sets high display standards with bright colors, sharp borders, and precise text characters. The eight image controls and 11 video connectors allow compatibility with almost any computer system.





The Electrohome 1312U uses a polished screen and a long-persistence phosphor that leaves a lingering afterglow. The image resolution is sharp, and the general performance is strong. Although the 1312U version is more appropriate for CAD/CAM users, it doesn't offer any other advantages over the 1310U model.

VGA Monitors: Summary of Features

(Products listed in ascending price order)

	IBM 8512 $595	IBM 8513 $685	Princeton PSC-28 $695	Compaq Video Graphics Color Monitor $699	Logitech AutoSync Monitor $699	Relisys RE5155 $795	Sony CPD-1303 $825	Princeton UltraSync $849
Measured screen size (diag. in inches)	12.8	11	11.6	13	13.3	13.3	13.3	11.6
Max. resolution	640 × 480	640 × 480	770 × 570	640 × 480	800 × 560	800 × 560	800 × 600	770 × 570
Case dimensions (inches)								
Height	13.4	12.3	12.4	14	13.7	13.7	13.5	12.4
Width	13.6	12.5	12.3	13.7	14.8	14.8	14.1	12.3
Depth	15.7	14.3	14.2	14.9	15.3	15.2	16	14.2
Tilt/swivel base	$35 extra	Included	Included	Included	Included	Included	$30 extra	Included
Bandwidth (MHz)	25.125–28.323	25.125–28.323	30	30	40	40	25	30
Vertical scanning frequency (Hz)	60–70	60–70	50–70	60–70	45–80	45–80	50–100	45–120
Horizontal scanning frequency (Hz)	31.5	31.5	31.5	31.5	15.5–35	15.5–35	15–35	15–35
Dot pitch (mm)	0.41	0.28	0.28	0.31	0.31	0.31	0.38	0.28
Glare protection	Etched screen	Etched screen	Etched screen	Etched screen	Etched screen	Etched screen	None	Etched screen
Text-mode color	N/A	N/A	White, green, cyan	N/A	White, amber, green	White, amber, green	N/A	White, amber, green
Cable length (inches)	77	71	74	73	35	33	51	73
Cable detachable	○	○	●	○	○	○	●	●
INPUTS								
RGB	○	○	○	○	●	●	●	●
Composite	○	○	○	○	○	○	○	○
Separate synchronization	○	○	○	○	○	○	○	○
Analog	●	●	●	●	●	●	●	●
Connector types	15-pin VGA	15-pin VGA	DB-25, 15-pin cable	15-pin VGA	DB-9	DB-9	DB-9	DB-25, 15-pin cable
CONTROLS								
Tint	○	○	○	○	○	○	○	○
Brightness	●	●	●	●	●	●	●	●
Contrast	●	●	●	●	●	●	●	●
Vertical position	○	○	○	○	●	●	●	●
Vertical size	○	○	○	○	●	●	●	●
Horizontal position	○	○	○	○	●	●	●	●
Horizontal size	○	○	○	○	●	●	●	●
Text mode	○	○	●	○	●	●	○	●
Text color	○	○	●	○	●	●	○	●
Control location	Side	Side	Side	Front	Back, side	Back, side	Back, side	Back, side
COMPATIBLE ADAPTERS								
CGA	○	○	○	○	●	●	●	●
MDA	○	○	○	○	●	●	○	●
EGA	○	○	○	○	●	●	●	●
PGC	○	○	○	○	●	●	●	●
VGA	●	●	●	●	●	●	●	●
Hercules	○	○	○	○	●	●	○	●
Compatible with Apple Macintosh	○	○	○	○	●	●	●	●

—Indicates Editor's Choice ●—Yes ○—No N/A—Not applicable; does not have this feature.

	Tatung CM-1495 $875	Electrohome 1310U $895	Electrohome 1312U $895	Magnavox 8CM873 $899	NEC MultiSync II $899	Nanao FlexScan 8060S $919	IBM 8514 $1,550
Measured screen size (diag. in inches)	13	13.3	13.3	13	13.3	13	14.3
Max. resolution	800 × 560	910 × 645	910 × 645	926 × 580	800 × 560	820 × 620	1,024 × 768
Case dimensions (inches)							
Height	13.2	14.5	13.2	13	14.4	14.6	14
Width	14.5	14.1	14.3	14.1	14	14	15.7
Depth	15.4	15.7	15.7	15.5	15.9	15.6	16.4
Tilt/swivel base	Included	$40 extra	$40 extra	None	Included	Included	Included
Bandwidth (MHz)	30	30	30	25	30	30	44.9
Vertical scanning frequency (Hz)	47–70	47–85	47–85	50–70	50–80	50–80	43.48
Horizontal scanning frequency (Hz)	15–35	15–34	15–34	15–34	15.5–35	15.7–35	35.51–35.52
Dot pitch (mm)	0.31	0.31	0.31	0.31	0.30	0.28	0.31
Glare protection	Etched screen	Etched screen	None	Etched screen	Etched screen	Etched screen	Etched screen
Text-mode color	White, amber, green	N/A	N/A	Green	White, amber, green	White, amber	N/A
Cable length (inches)	43	61	60	71	67	78	70
Cable detachable	●	●	●	●	●	●	○
INPUTS							
RGB	●	●	●	●	●	●	○
Composite	○	○	○	○	○	●	○
Separate synchronization	○	●	●	○	○	○	○
Analog	●	●	●	●	●	●	●
Connector types	DB-9	DB-9, 5 BNC	DB-9, 5 BNC	DB-9	DB-9	DB-9	15-pin VGA
CONTROLS							
Tint	○	○	○	○	○	○	○
Brightness	●	●	●	●	●	●	●
Contrast	●	●	●	●	●	●	●
Vertical position	●	●	●	●	●	●	○
Vertical size	●	●	●	●	●	●	○
Horizontal position	●	●	●	●	●	●	○
Horizontal size	●	●	●	○	●	●	○
Text mode	●	○	○	●	●	●	○
Text color	●	○	○	○	●	●	○
Control location	Front, back, top	Front, back	Front, back	Front, back	Front, back	Front, back	Side
COMPATIBLE ADAPTERS							
CGA	●	●	●	●	●	●	○
MDA	●	○	○	○	●	●	○
EGA	●	●	●	●	●	●	○
PGC	●	●	●	●	●	●	○
VGA	●	●	○	●	●	●	●
Hercules	●	○	●	○	●	●	○
Compatible with Apple Macintosh	●	●	●	●	●	●	○

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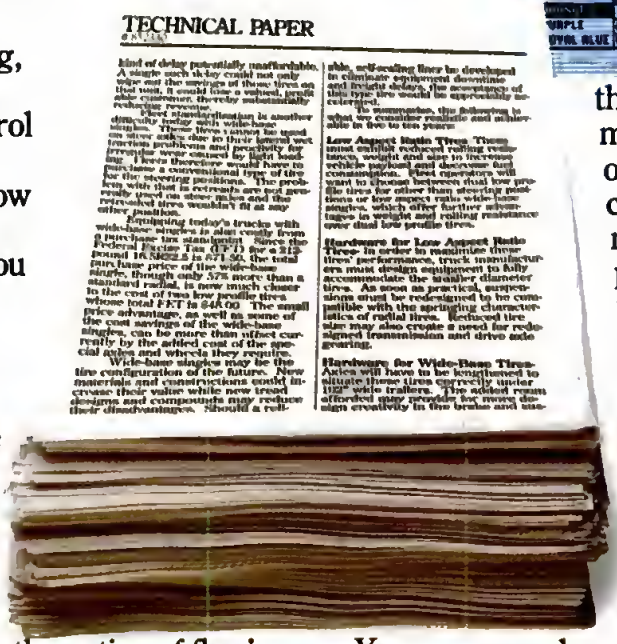

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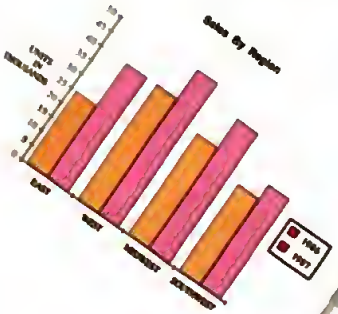

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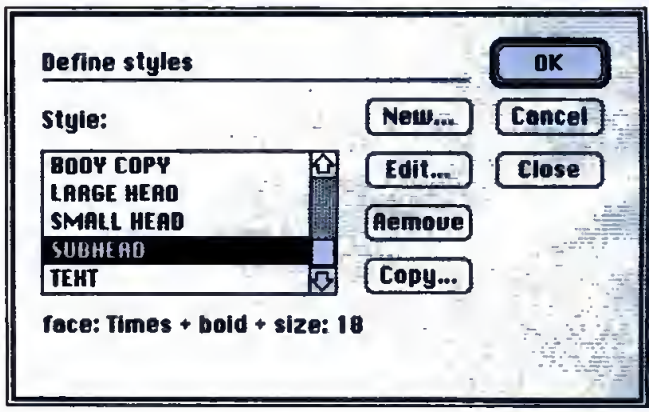

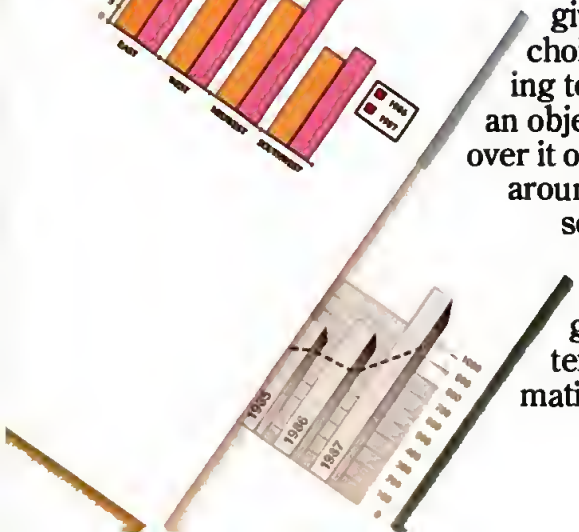

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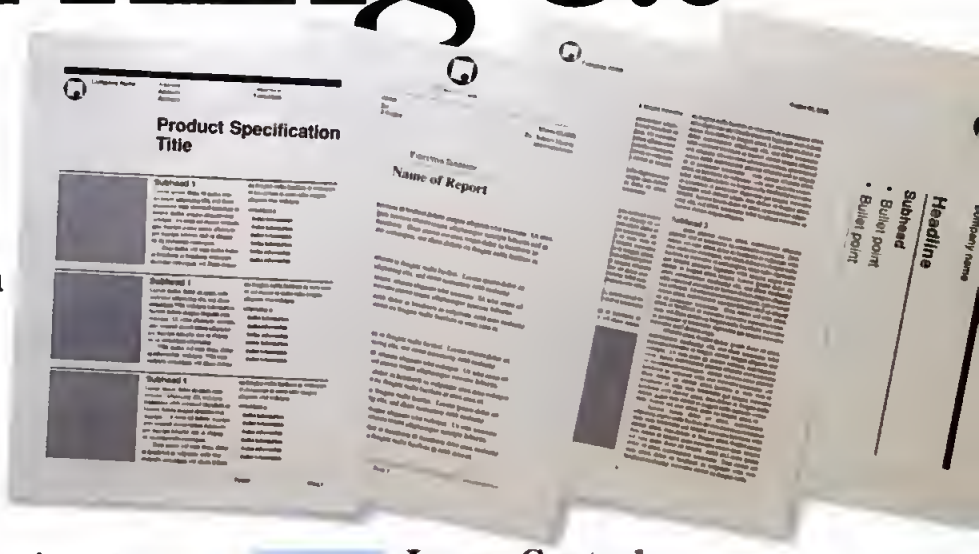

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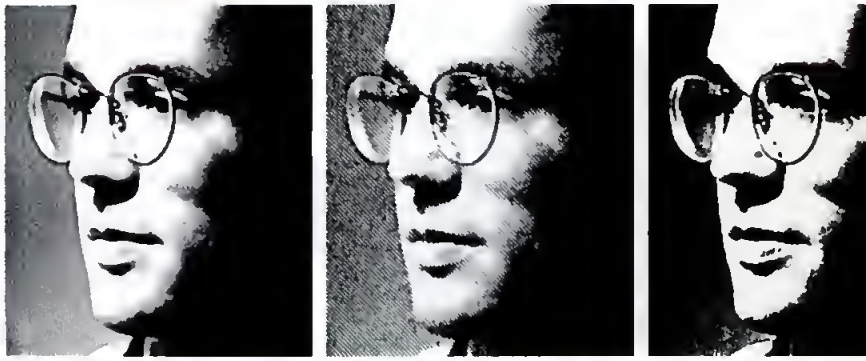

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CIRCLE 150 ON READER SERVICE CARD

mal (single-monitor) operation, each terminator switch would be closed, but opening them lets you daisy-chain multiple monitors—perfect for classroom and presentation purposes. A better approach, perhaps, would be a single switch that controls all five terminators.

When it comes to video performance, the 1310U takes a back seat to none. Colors are better than those of most, with only yellow a bit understated. Only at extreme brightness levels does the background begin to fade from its excellent black shade to gray.

■ The etched screen and conventional phosphor of the Electrohome 1310U should appeal to a much wider audience than does the 1312U, with its lingering images.

A slight amount of image softening could be detected in the corners when compared to the center of the screen, but it never interfered with overall legibility. Borders between adjacent color bars were sharp, and text characters suffered no color fringing.

Electrohome's 1312U, with its unique long-persistence phosphor, has similarly good color performance but really didn't offer any particular advantages—and the long, green afterglow was annoying. Images from bright characters could still be read 5 seconds after the screen area turned black.

With applications in which the entire screen is predominantly illuminated, such as *Microsoft Windows*, the persistence is much less noticeable. What might still prove to be objectionable, though, is the high level of glare off the polished glass screen. Even Electrohome's optional ($40) spring-counterbalanced tilt/swivel base couldn't eliminate the distracting re-

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CIRCLE 170 ON READER SERVICE CARD

■ VGA MONITORS

flections under many backlit conditions.

Although both Electrohome monitors offer exemplary performance, the etched screen and conventional phosphor of the 1310U should appeal to a much wider audience than does the 1312U, with its lingering images. For those with larger aspirations, Electrohome's mammoth 19-inch multiscanning monitor will be reviewed in an upcoming issue of *PC Magazine*.

IBM CORP.
IBM 8512
IBM 8513
IBM 8514

Since IBM established the VGA display as a true standard for the PC (and PS/2) community, it's not unreasonable to expect the company's VGA monitors to be pacesetters, too. But stack them up against the competition, and each of IBM's VGA monitors comes up short in one way or another.

Heading up the line is the 40-pound, $1,550 multiscanning 8514, whose 14.3-inch screen makes it the largest monitor in the group reviewed here. Its maximum resolution is 1,024 by 768 pixels.

The best image on our 8514 was obtained with the contrast control set to maximum and the brightness control resting at the midposition detent. Only an average amount of luminosity was displayed at these settings, but turning the brightness up further changed the background from black to dark gray.

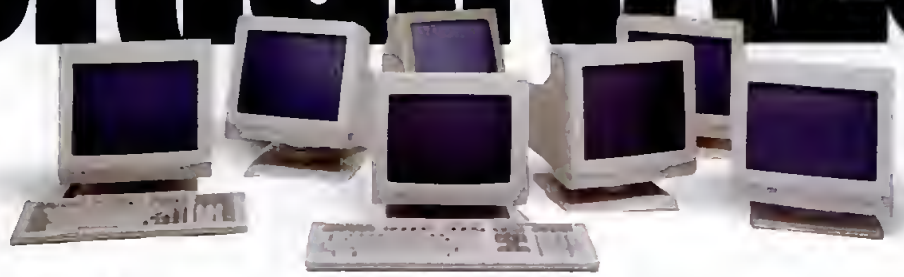
Characters were adequately though not exceptionally sharp at all points on the screen, although a small amount of red-fringing was observed along the left edge. Colors were accurate, even the usually difficult brown. Out of all the colors, only the light red was weak.

The 8514's lack of linear distortion and image blooming should win fans in the CAD/CAM community. All four sides of the display were ruler-straight, and, regardless of the brightness level, the image size remained the same.

Where some of the monitors are replete with every knob short of a tone control, the 8514 is a model of simplicity. A power

SAMTRON

SAMSUNG'S AMERICAN ORIGINALS



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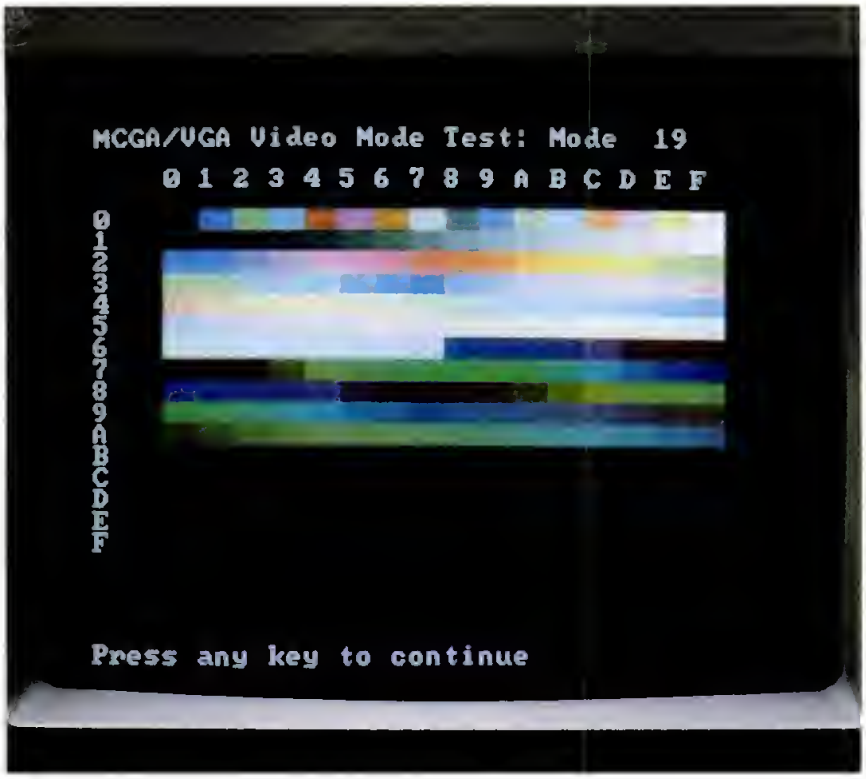
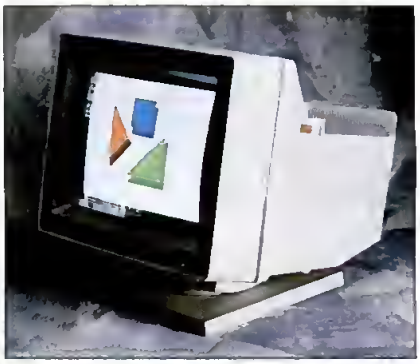
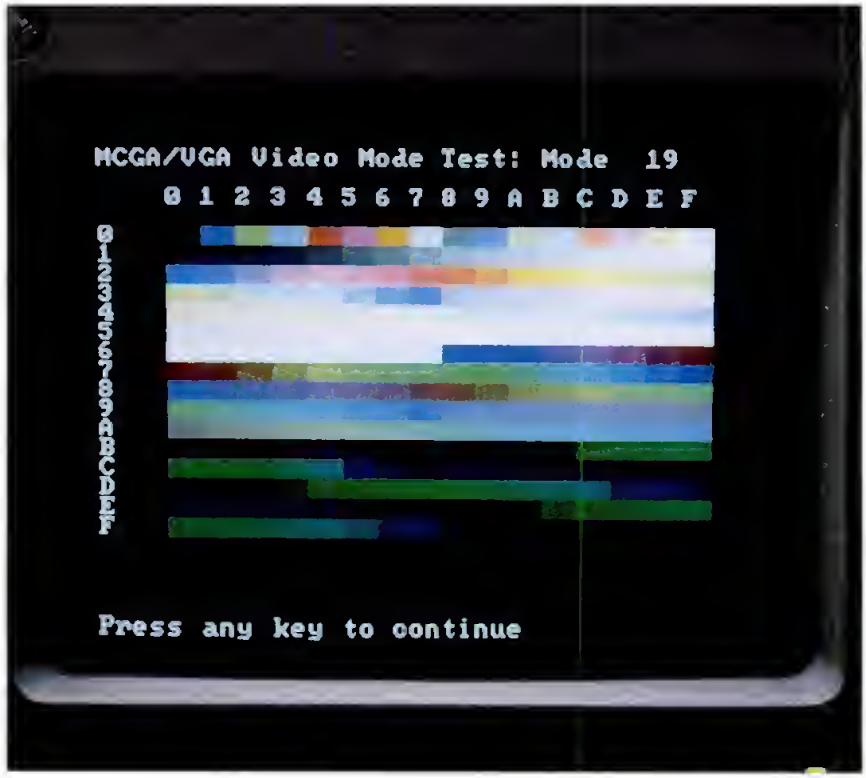
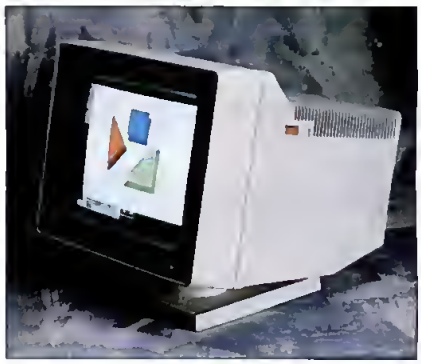




Although the IBM 8512 is reasonably priced ot $595, its coarse dot pitch produces grainy characters, and the colors are dull, with poor contrast. Although the cabinet is attractive, it is held by a weak tilt-ond-swivel stand that effects minimal support. Its low price seems appropriate for the quality of this monitor.





The lack of screen-sizing controls on the IBM 8513 makes it difficult to regulate imoge size and position. Colors are dreary, and the poor contrast makes it difficult to distinguish light shades from dark. The 8513 also has poorly aligned color guns that result in blurred images, ond the low power supply limits the brightness level of the screen.

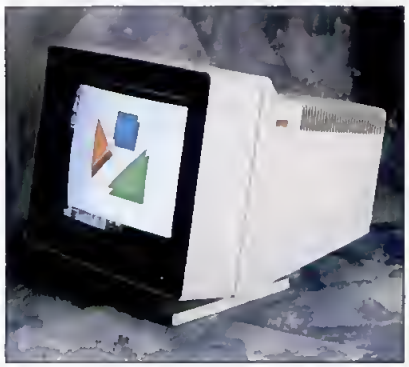
switch resides on the right side of the cabinet, and the brightness and contrast knobs live on the left. Despite this paucity of adjustments, the image was perfectly centered on the screen, with a ⅜-inch margin all around.

Image glare is average for an etched screen, and a smooth-moving tilt/swivel base makes it easy to eliminate bothersome reflections.

I rather like the 8514's performance, but the price is hard to swallow. At $1,550, it's half again as expensive as some other monitors reviewed here, and several of those in the $800 bracket offer superior performance.

At the other end of IBM's VGA lineup is the 12.8-inch $595 entry-level 8512. A quick check through the mail-order ads in *PC Magazine* reveals street prices as low as $450, which should make it a strong competitor among these products. Its video performance, controls, and construction quality, though, leave a lot to be desired.

Weighing in at 40 pounds and sporting a 14.3-inch screen, the IBM 8514 is the largest monitor reviewed here. It has a maximum resolution of 1,024 by 768 pixels. The absence of linear distortion and image blooming makes it worthwhile for CAD/CAM users, but the general performance is not exceptional and may not justify the high price tag of $1,550.



PC MAGAZINE FACT FILE

IBM Corp.
1000 NW 51st. St.
Boca Raton, FL 33432
(800) 447-4700

IBM 8512
List Price: $595
Requires: VGA video adapter.
In Short: IBM's 12.8-inch entry-level VGA monitor is relatively inexpensive but suffers from poor video performance and gives a general impression of low-quality construction.
CIRCLE **697** ON READER SERVICE CARD

IBM 8513
List Price: $685
Requires: VGA video adapter.
In Short: Both more expensive and smaller (11-inch screen) than the 8512, the 8513 has no real improvements in video performance to offer for its higher price.
CIRCLE **696** ON READER SERVICE CARD

IBM 8514
List Price: $1,550
Requires: VGA video adapter.
In Short: The 14.3-inch top-of-the-line IBM VGA display offers adequate (though hardly outstanding) image capabilities, but its premium price tag puts it beyond the means of all but the deepest pockets.
CIRCLE **695** ON READER SERVICE CARD

The 8512's cabinet is handsome enough, and, of course, is a perfect match for the PS/2 family of computers. Beneath it, however, is a chintzy tilt-and-swivel base. The plastic used is too flexible, and it suffers from a high level of friction. It takes two hands to move the display, particularly along the vertical axis.

As with the other IBM monitors, controls are limited to the left-side-mounted brightness and contrast controls.

COARSE DOT PITCH The 8512 has an unusually coarse dot pitch (0.41mm) that produces only marginally legible characters. The good news is that the image doesn't degrade at the corners. The bad news is that it isn't particularly sharp in the center to begin with. Maximum resolution is 640 by 480 pixels.

Color isn't a strong point, either. All of the colors look drab, and the lighter colors aren't easily distinguished from their darker counterparts, even with the contrast control placed at its maximum setting. The

boundaries between adjacent color bars are particularly indistinct, no doubt due to the coarse dot pitch.

The PC Labs *Windows* benchmark test brought out the worst in the 8512. With most of the screen area illuminated, black text characters became washed out and much less legible than those on most of the other monitors. Furthermore, painting the screen with solid colors revealed a dark splotch near the center of the screen along the horizontal axis that was most apparent when the screen background was red.

■ The Logitech AutoSync and Relisys RE5155 were at their best running applications such as *Windows* that minimize the area of the screen left black.

A substantial amount of pincushion distortion was evident along the vertical edges, with a smaller amount along the top and bottom. This will discourage CAD and DTP users.

IBM's middle-of-the-road 8513 VGA monitor prompts the question, "Why bother?" Despite its tighter (0.28mm) dot pitch, the image on its smaller (11-inch) screen offers no performance advantage over the 8512 (maximum resolution is the same: 640 by 480 pixels), and the 8513 costs more: $685 versus $595.

Like the other two IBM products, the 8513 has only side-mounted brightness and contrast controls, and this time, the screen-sizing controls were sorely missed. The active image area of the screen (which measured only 9.8 inches) on our review unit was miscentered somewhat to the upper-left-hand corner. Size and position controls would be welcome here.

The color guns on the 8513 we reviewed were not properly aligned, resulting in a fringing along both sides of the characters: blue to the left and red to the right. The image deteriorated substantially in the corners when compared with the center of the screen.

Although the colors were reasonably bright and accurate, the borders between adjacent color bars were indistinct. This was particularly noticeable when running *Windows*, with its polychromatic display area.

Only a slight amount of pincushion distortion could be seen in the form of inward bowing of the left and right edges, but the benchmark test designed to reveal image blooming brought out what may have been a weakness in the 8513's circuitry design. Although the blooming exhibited while cycling up the red, green, and blue color guns separately showed an average amount of image growth, the 8513 seemed to reach a plateau in intensity when cycling from gray to white with all three guns powered up. Perhaps the power supply wasn't up to the task, but the image would brighten up to a certain point and then it would level out.

None of IBM's VGA monitors is competitive with third-party offerings. The 8514 is nice but just too expensive; the 8512 is cheap, and it shows; and the 8513 doesn't seem to have any reason to exist. The best reason I can think of for recommending one of the IBM monitors is that the diagonally-oriented "IBM" logo is a perfect match for the one on a PS/2.

LOGITECH
Logitech AutoSync Monitor
RELISYS
Relisys RE5155

These two monitors are marketed by different companies, but they share a common origin—TECO, a Taiwanese electronics conglomerate. Relisys is a wholly owned subsidiary of TECO and serves as its U.S. marketing arm, whereas Logitech acquires the same monitor on the OEM market for resale under its own label. Oddly, at $795, the Relisys costs about $100 more than the Logitech-labeled model.

Whatever the label, this 13.3-inch monitor suffers from lackluster performance and inconvenient placement of some important controls. Resolution is 800 by 560 pixels.

The level of brightness from either screen was judged to be acceptable only if both the brightness and contrast controls were set to their maximum positions. Turning either one down caused the disappearance of the dimmer VGA colors on the PC Labs benchmark tests. The RE5155, possibly because of rough handling in shipment, also had a misaligned red color gun, resulting in a brownish background under virtually all operating conditions.

Characters were generally sharp, with only the slightest amount of softening in the corners, and linear distortion was insignificant (the Logitech exhibited a trace of pincushion distortion along the left and right edges, while the Relisys showed none). Image blooming with rising brightness on either monitor was about average.

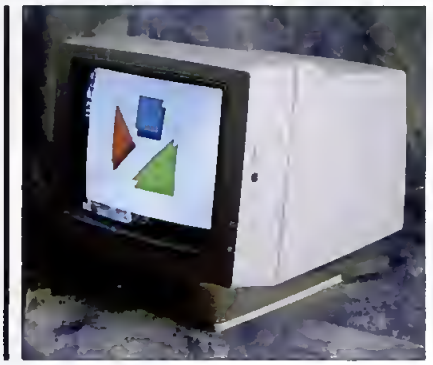
Both monitors were at their best running applications such as *Windows* that minimize the area of the screen left black. Their competitors, though, were just as

PC MAGAZINE FACT FILE

Logitech AutoSync Monitor
Logitech
6505 Kaiser Dr.
Fremont, CA 94555
(415) 795-8500
List Price: $699
Requires: Any IBM-standard video display adapter.
In Short: An OEM product from TECO, the 13.3-inch AutoSync has mediocre performance and inconveniently placed controls.
CIRCLE 693 ON READER SERVICE CARD

Relisys RE5155
Relisys
320 S. Milpitas Blvd.
Milpitas, CA 95035
(408) 945-9000
List Price: $795
Requires: Any IBM-standard video display adapter.
In Short: The same basic product as the Logitech, the RE5155 is marketed by TECO's wholly-owned U.S. subsidiary, Relisys. In terms of performance and ergonomics, however, it suffers in all of the same ways and is more expensive, to boot.
CIRCLE 692 ON READER SERVICE CARD

The Logitech AutoSync and the Relisys RE5155 are basically the same monitor, hence they suffer from basically the same flaws: both have poor brightness levels and lack automatic vertical image size adjustment. The greatest difference is the price: for some reason the Relisys retails for about $100 more than the Logitech.



good or even better, while preserving a clear, crisp display with predominantly black images.

Despite their multiscanning capabilities, both the Relisys and Logitech monitors lack automatic vertical image size adjustment. This makes switching from true VGA mode to CGA or EGA emulation rather frustrating. When adjusted to the proper 1.33 horizontal-to-vertical aspect ratio when in VGA mode, the switch to IBM's earlier graphics modes resulted in a vertically compressed 1.54 aspect ratio. This wasn't a handicap with text-based programs, but was readily apparent with graphics applications.

The vertical sizing problem wouldn't matter so much if the compensating manual control (along with all of the other switches and knobs) was more conveniently located. Under a small trap door located on the left side of the monitor are the controls for brightness, contrast, vertical size and position, horizontal size (a two-position switch) and position, and a switch that is used for selecting monochromatic text mode (which is nonfunctional with an analog display adapter).

On the back of both the Relisys and Logitech monitors are toggle switches for selecting TTL or analog operation, and automatic or manual synchronization. A bank of DIP switches selects which color guns will be used when the text mode switch is enabled with a TTL display adapter (like the CGA or EGA). Consequently, you can elect to have the black background display text in your choice of red, green, blue, yellow, cyan, magenta, or white. Unfortunately, the VGA viewer is left out in the cold with this one.

The space on the front of the RE5155 and AutoSync monitors that should be devoted to at least the brightness and contrast controls is instead occupied by four LEDs, three of which are of dubious value. No one will question the utility of the power light, but the others show whether the monitor is operating in TTL or analog mode and whether it is using automatic or manual sync—with a tricolor LED indicating CGA (green), EGA (red), PGC (yellow), or VGA (off) modes. Inasmuch as these selections are a function of the switch settings and host adapters, there seems little reason for these lights.

■ On the back of the Relisys and Logitech monitors are toggle switches for selecting TTL or analog operation, and automatic or manual synchronization.

Given the superior video and ergonomic performance offered by other comparably priced monitors, there is little to recommend the Logitech AutoSync or Relisys RE5155. If you have your heart set on one, though, be aware that the list price of the Logitech is nearly $100 less than that of the Relisys.

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NANAO

Nanao FlexScan 8060S

Seldom does a piece of computer hardware prompt any sense of artistic passion, but the Nanao FlexScan's cabinet has a distinct "art deco" flavor to it.

While the styling may be reminiscent of the past, the performance of the 13-inch, $919 FlexScan 8060S is state of the art. With its multiscanning operation and a bevy of controls, it should be compatible with most any display adapter available now or in the near future. Maximum resolution is 820 by 620 pixels.

The most important controls (brightness, contrast, vertical and horizontal size, and text mode) are thoughtfully placed along the lower edge of the front bezel. On the rear of the monitor are the controls not likely to need a lot of attention except when moving the display to another computer. These include switches for selecting analog or TTL operation, automatic or manual scan rates, and a group of DIP switches that select 8-, 16-, or 64-color operation when used with a display adapter other than the VGA. Also on the back are a pair of potentiometers for vertical and horizontal image positioning.

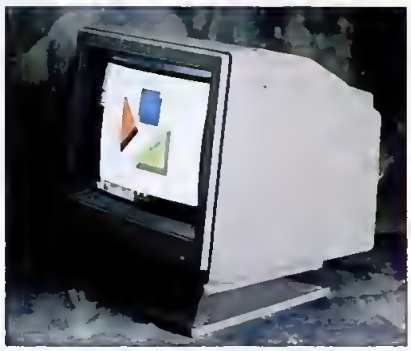
The image quality of the FlexScan 8060S is about average. With the contrast control set to maximum and the brightness control at approximately two-thirds of maximum, colors are reasonably bright and generally clean. Only brown was rendered less than accurately—it tended more toward burnt umber.

Text characters are sharp and legible, and there is virtually no degradation when comparing the corners to the center of the screen. Linear distortion was notable only for its absence, making this monitor a good choice for CAD/CAM work.

Turning the brightness control up toward the maximum resulted in a significant loss of image sharpness. The display's background, however, remained a jet black color even at brightness levels that no one is ever likely to require.

If there is one flaw in this otherwise vivid display, it can be found by moving the text mode switch from the full-color position. One mode is supposed to change all of the nonblack characters to amber on a black background, and the other should change everything but black into shades of white or gray on black. Unfortunately, stray colors manage to creep through in either mode, resulting in what appears to be a washed-out color image. It is better to forget that this switch even exists and just

The Nanao FlexScan 8060S has a distinctive retro styling that makes it stand out from the other monitors. The color quality is average—with well-defined text characters and no noticeable linear distortion—and the tilt-and-swivel base helps eliminate glare. As an extra bonus, a pair of video cables are also included in the package.



PC MAGAZINE FACT FILE

Nanao FlexScan 8060S
Nanao
23510 Telo Ave., #5
Torrence, CA 92505
(213) 325-5202
List Price: $919
Requires: Any IBM-standard video display adapter.
In Short: An attractive and capable 13-inch multiscanning monitor, well suited to the requirements of the VGA adapter. You're better off if you don't really need the monochrome text switch, since it results in rather disappointing performance.

CIRCLE 881 ON READER SERVICE CARD

PC programs & pe

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leave it set to full-color mode.

The Nanao monitor was adept at displaying *Microsoft Windows* applications. Here, its excellent sharpness and accurate colors resulted in a beautiful and legible image.

Rounding out the FlexScan package is a pair of ample-length video cables, one with a 15-pin connector for VGA boards and the IBM PS/2 Models 50, 60, and 80, and another with a conventional DB-9 connector for earlier display standards. A tilt-and-swivel base is included to help reduce glare from the etched (but still somewhat shiny) screen. Should you need to move it about much, you'll appreciate its smooth, low-friction action.

The Nanao FlexScan 8060S is a rather impressive display if you don't mind pretending that the text-mode switch doesn't really exist.

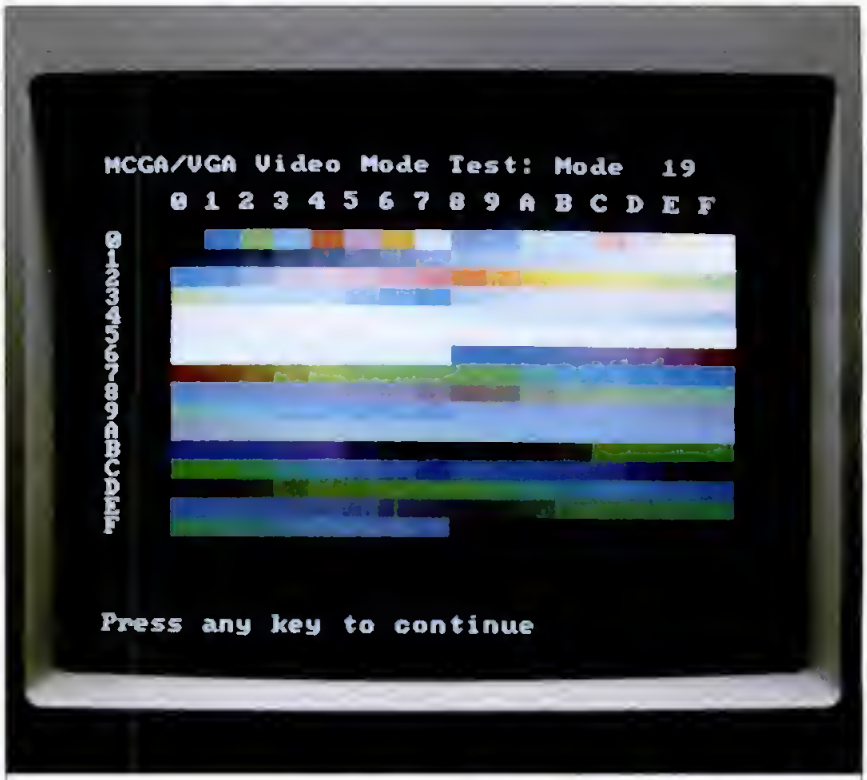
NEC HOME ELECTRONICS (USA) INC.
NEC MultiSync II

When IBM first released the Enhanced Color Graphics standard, it didn't exactly take off like a rocket. Not only was a new video controller required to run the EGA drivers on those few software packages that initially supported it, but the IBM EGA monitor wasn't compatible with earlier (CGA and MDA) video standards.

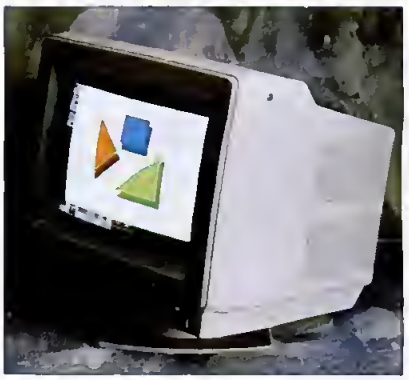
NEC to the rescue. Its original MultiSync monitor worked equally well with all of these display adapters, as well as with the Hercules Monochrome Graphics Adapter, and became an instant sales hit. Its only shortcoming (in hindsight) was that it didn't look quite far enough into the future to include automatic vertical image sizing.

Enter NEC again with the $899 MultiSync II, a superb 13.3-inch graphics monitor that functions comfortably in all of those earlier modes as well as in IBM's current Video Graphics Array—and probably the next-generation video mode as well. With a maximum resolution of 800 by 560 pixels and automatic selection of synchronization rates, it should meet graphics needs for some time to come.

The NEC MultiSync II is distinguished by exceptionally high brightness capabilities. Even with the brightness control turned to maximum, the background remains a deep black, although the clarity of individual characters falls off at the ex-



NEC has produced a first-class monitor with the MultiSync II. The characters are unusually bright, the colors are rich, and the maximum resolution of 800 by 560 pixels will satisfy most graphics needs. The cabinet itself is also well-designed, with knobs and controls placed in convenient reach of the user.



EDITOR'S CHOICE

PC MAGAZINE FACT FILE

NEC MultiSync II
NEC Home Electronics (USA) Inc.
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Elk Grove Village, IL 60007
(312) 228-5900
List Price: $899
Requires: Any IBM-standard video display adapter.
In Short: Another superior product from the company that brought us the original multiscanning monitor. Updated to the VGA standard (and beyond), the crystal-clear 13.3-inch MultiSync II takes a back seat to no one when it comes to overall video performance.

CIRCLE 690 ON READER SERVICE CARD

treme high end. The best image occurred with the contrast control at midpoint and the brightness control at around three-quarters.

Colors rendered by the NEC are quite accurate, even the ever-difficult brown. That the three color guns appeared to be operating with equal intensity no doubt contributed to the excellent purity of colors, particularly white.

Although this monitor is generally in its glory when running graphics-based software like *Windows*, CAD users should be aware that there is a slight amount of pincushion distortion along the left and right edges of the screen. It's doubtful that it is enough to hinder work, but it is noticeable.

Ergonomically, the MultiSync II leaves little to be desired. The most-often used contrast and brightness controls are mounted along the lower-front edge of the display's bezel. A fold-down door on the front reveals the controls for vertical and

■ The NEC MultiSync II functions comfortably in older modes as well as in IBM's VGA.

horizontal size and position and switches for text mode and text color. Only the switches for manual or automatic scan rate, and for selecting between 8-, 16-, and 64-color modes (only when operating with TTL boards), are mounted on the back of the cabinet. You're unlikely to have to change the rear controls very often (if at all), so their placement there is inconsequential.

A bigger disappointment came when trying to use the text mode and color (white, green, and amber) switches when connected to the VGA output of the IBM Model 80. They function only with older TTL boards (like the CGA and EGA) and have no effect with the analog output of the VGA port. It's color or nothing.

NEC also makes two larger multisync monitors: the 16-inch MultiSync Plus ($1,399) and the monstrous 20-inch Multi-

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CIRCLE 269 ON READER SERVICE CARD

Sync XL ($3,199). Both will be reviewed in future issues of *PC Magazine*.

With its outstanding colors, clarity, and an exemption from planned obsolescence, the NEC MultiSync II is one of the best monitors to consider for VGA-based systems.

PHILIPS ELECTRONICS CORP. Magnavox 8CM873

A few unique features on the $899 Magnavox 8CM873 seem distinctly out of place when compared to the conservative, starched-collar attitude evident in all of the other monitors we tested. Start with an audio input, add a volume control and an internal speaker, and throw in an earphone jack—and you end up with a 13-inch monitor some might write off as a toy for playing games on an Amiga.

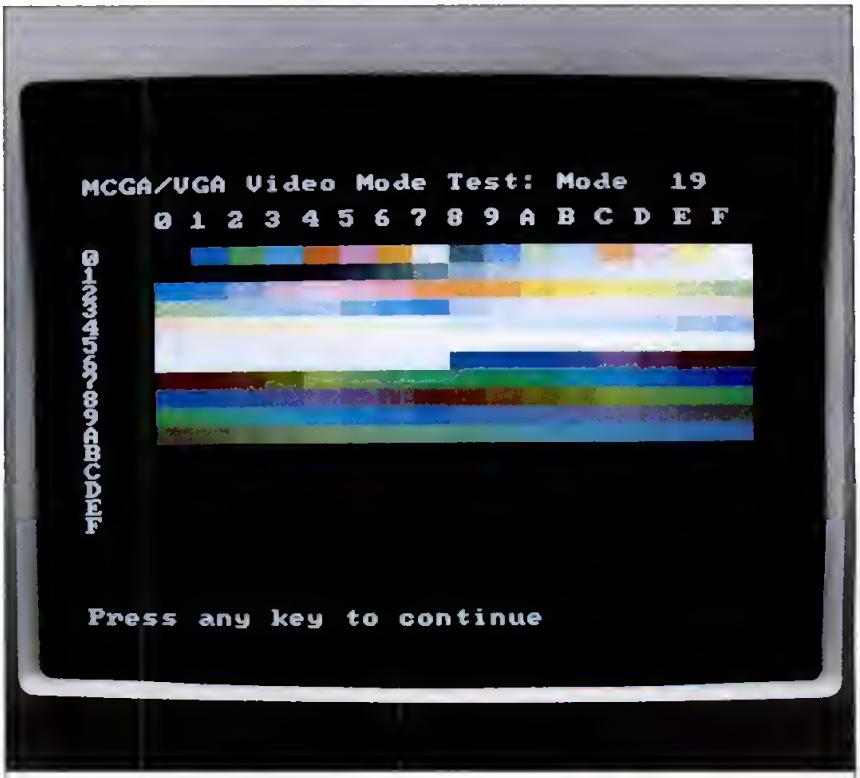
Well, think again, because the incorporation of audio circuitry into this monitor hardly detracts from its performance as a capable multiscanning display, one well-suited to the VGA standard. Instead, it's a welcome addition if you ever care to hook the display up to an Amiga or Macintosh.

The 8CM873's image quality is a notch above average for all of the monitors tested. Maximum resolution is 926 by 580 pixels. White is distinctly clean, and even brown comes through without the usual orange cast. Only light cyan was less than perfect, tending more toward pale violet. Edges between adjacent color bars in one of the PC Labs benchmark tests were quite sharp. The best image was obtained with both of the front-mounted brightness and contrast controls set to midposition. Turning the brightness up from this already radiant level caused the background to wash out some, while increases to the contrast knob caused some of the darker VGA colors to disappear into the background.

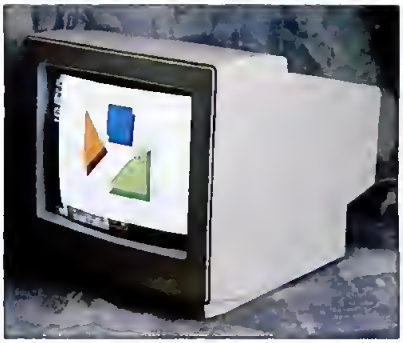
There was a slight amount of linear distortion present along the left edge of the image area. It started out as barrel distortion from the top-left corner, changed to pincushion distortion about a third of the way down, and then continued on to the bottom.

The Magnavox 8CM873 has the most heavily etched screen of all of these monitors, resulting in almost total elimination of background glare. This was especially appreciated since our review unit did not come with the optional tilt-and-swivel base. Overzealous etching can sometimes reduce image clarity, but that's not the case here.

A front-mounted text switch allows col-



The Magnavox 8CM873 is unique among this selection of monitors for its audio input, volume control, internal speaker, and an earphone jack. Besides offering all these audio perks, it gave a strong performance as a multiscanning display with its brilliant color, clarity, and a heavily etched screen that strongly reduces the background glare.



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Magnavox 8CM873
Philips Electronics Corp.
P.O. Box 14810
Knoxville, TN 37914
(615) 521-4316
List Price: $899
Requires: CGA, EGA, PGC, or VGA graphics adapter.
In Short: A competent and versatile 13-inch multiscanning monitor, it is the only one available that combines VGA compatibility with audio circuitry for use with a wide variety of systems.

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Its true 32-bit architecture lets you perform real multi-tasking *and* it supports multiple users with simultaneous data access.

But there's much more to the AT&T 6386 WGS than the powerful features that make it a superior computer today.

The 6386 WGS is part of a family of AT&T computers that share an open architecture and interface called the AT&T Application Operating Environment.

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So, no matter what exciting new opportunities the software industry provides, the AT&T 6386 WGS is ready for them.

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To help protect your current software investment we offer a machine that can run in all major operating environments including MS*-DOS, Windows/386, OS/2, UNIX System V, and Simul-Task 386.

Rapid changes in today's software world mean your computer must be ready for anything that comes along.

And it must be able to run all of your existing DOS software: word processing, spreadsheets, databases, forecasting packages, and so on.

The powerful 80386 chip in the AT&T 6386 WorkGroup System works with Windows/386 so you can multi-task DOS applications simultaneously – the number of applications is limited only by your expandable RAM capacity.

As OS/2 applications emerge, your 6386 WGS will be ready to run them.

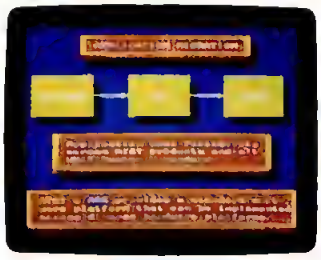
Plus you get the power of UNIX* System V; make the 80386 chip fly as you run powerful multi-tasking UNIX System applications, while Simul-Task 386 lets you concurrently run your DOS applications in their own windows.

And your 6386 WGS can serve up to 32 connected terminals in a multi-user environment.

Take advantage of PC enhancements when opportunities arise.

Running out of expansion slots in your computer is a major headache.

And since the industry promises even more exciting and powerful plug-in boards tomorrow, the problem is just going to get worse.



So, in addition to providing for more memory, the 32-bit path lets you plan ahead now for high-performance boards in the future.

The 6386E WGS has an unprecedented 10 expansion slots: four 32-bit paths, four 16-bit slots, and two 8-bit slots. (8 and 16-bit boards can be used in the 32-bit slots.)

The 6386 WGS offers seven slots: three 32-bit, two 16-bit, and two 8-bit.

No other 386 computer series gives you more expandability.

Add up to 5 magnetic peripherals inside the machine.

The AT&T 6386 WGS lets you add up to five mass-storage peripherals including tape drive – *right in the machine.* Why clutter up your desk with outboard units?

Keep on using your current media by choosing inboard 3½-inch with a 5¼-inch disk drive option.

Why waste time converting all of your 5¼-inch diskettes just to accommodate a machine that forces you to use 3½-inch diskettes?

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The 6386E WGS flies with its 20-megahertz clock speed (16 or 20 megahertz for the 6386 WGS).

Choose from four industry-standard graphics protocols: EGA, CGA, MDA, and AT&T.

The 6386 WGS series supports virtually every graphics display device on the market.

Get total compatibility with existing XT and AT computers.

The AT&T 6386 WorkGroup System is totally hardware-compatible with the IBM** XT and AT.

Virtually all the plug-in boards designed for earlier 8086 and 80286 machines will work in the AT&T 6386 machines.

Expand RAM as needed.

As new operating systems emerge, you need all the RAM you can get.

Today's new operating systems and applications are significantly more memory-hungry.

FEATURE	AT&T 6386 WGS	AT&T 6386E WGS
PROCESSOR	80386	80386
CLOCK SPEED	16/20MHz	20MHz
RAM (STANDARD)	1MB	2MB
5.25" DISKETTE	1.2MB 360KB	1.2MB 360KB
3.5" DISKETTE	1.44MB	1.44MB
TOTAL INTERNAL DEVICES	3 1/2HT +1 FULL	3 1/2HT +2 FULL
TOTAL HARD DISK CAPACITY	435MB	600MB
STREAMING TAPE BACKUP	40, 60 OR 125MB	40, 60 OR 125MB
EXPANSION SLOTS	7	10

More RAM lets you run multi-tasking and multi-user applications much more quickly. You avoid wasting time in unnecessary disk access, because the 6386 WGS lets you expand RAM as your needs increase.

Plan for the future by entering the AT&T Application Operating Environment.

If you're running PC applications today and find that you need to enlarge your workgroup sometime in the future, you won't have to build an applications library from scratch.

The AT&T AOE lets you port your UNIX System V software essentially unchanged to departmental size minis (including AT&T's 3B computer family & RISC based machines) and mainframes, so you can start running powerful 386-based applications now, without fear for tomorrow.

At the same time you can build a fully networked PC workgroup.

The 6386 WGS is compatible with a wide range of peripherals, including AT&T's laser, letter-quality, dot-matrix, and line printers; plotters; and high-performance display terminals.

A single AT&T STARLAN Network can link from 2 to over 100 PCs, which means individuals in your workgroup can share printers, access the same data, and send messages.

AT&T's modular architecture and twisted-pair wiring make it easy for you to add stations as needed.

How to protect your freedom of choice.

To avoid buying the wrong machine, take a close look at the AT&T 6386 WorkGroup System. For more information on the 6386 WGS, the AT&T STARLAN Network, AT&T printers and terminals, and the Applications Operating Environment, call your AT&T Account Executive, Authorized AT&T Reseller, or dial 1 800 247-1212. AT&T can arrange for you to examine the 6386 WorkGroup System, the STARLAN Network, and other components you'll need to build a productive workgroup. Either at a facility near you or by special arrangement at your business location.

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ors to be converted to three shades of green, and although it wasn't marred by the bleedthrough that plagued a couple of the other monitors, you might have a problem with text normally displayed as blue, red, or magenta. These colors are converted to black.

On the rear of the fairly compact and generically styled cabinet (remember, this one might just as well find a home with a Mac) are switches for analog or digital (TTL) operation, and one labeled "normal/special." Normal mode is the one intended for any IBM color graphics adapter, while the special position is intended, according to the manual, for "custom graphics adapters displaying up to 64 colors and vertical resolution of 400 or more lines." Exactly which adapters those might be isn't explained.

Also on the rear are three vertical size controls. One is for use with horizontal scanning frequencies of 15 to 17 kHz (CGA adapters), the second for EGA-class 21 to 25 kHz, and the third for the VGA's 29 to 34 kHz scanning rate.

■ The Magnavox 8CM873's image quality is a notch above average for all of the monitors tested.

If you tend to switch between VGA mode and CGA emulation often, you'll quickly become frustrated with the inconvenient placement of the vertical size controls because the lack of automatic vertical sizing results in squashed CGA images when correctly adjusted for VGA. It isn't a problem with text-based programs, but graphics, especially circles, suffer from the resulting 1.54 aspect ratio.

Provided you can live with the vertical size controls, though, the Magnavox 8CM873 is certainly worth consideration. And if you ever expect to attach it to a system with an audio output, then it is the only choice.

PRINCETON GRAPHIC SYSTEMS
Princeton PSC-28
Princeton UltraSync

Princeton Graphic Systems has built a pair of monitors that do the same thing, but in markedly different ways. The PSC-28 is small and lacks a few amenities, but its performance is commendable and the $695 price is affordable. The UltraSync, on the other hand, has performance and features that few of its larger competitors can match. And, yes, at $849 it costs significantly more as well.

Let's look first at the pinnacle of Princeton's lineup—the 11.6-inch UltraSync. Quite simply put, its display image is as sharp as a stiletto and as bright as an arc lamp (maximum resolution is 770 by 570 pixels). It is capable of brightness lev-

The Princeton UltraSync and PSC-28 monitors both produce vivid colors, luminous characters, and sharp images. The UltraSync has one of the best text modes to be found, as well as a 0.28mm dot pitch that produces sharp color borders. Both the UltraSync and PSC-28 monitors are highly recommended.

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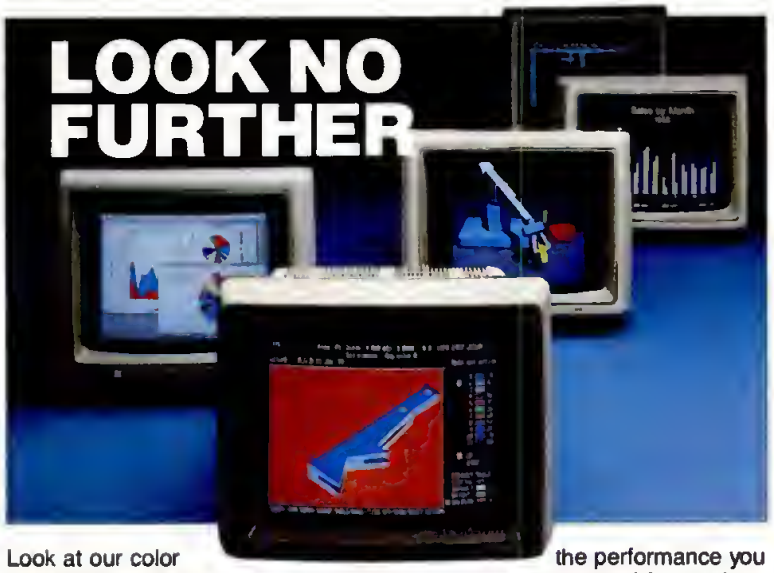

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■ VGA MONITORS

els that are almost painful to look at for long. Even as the brightness is turned up to such a level, the characters displayed on the 0.28mm dot-pitch screen remain clear and sharp. The only negative aspect of this luminosity is that, even with the contrast control set to maximum, the background begins to wash out to dark gray as the brightness control approaches maximum. At more temperate levels, though, it is a satisfying black.

Some slight softening of the image was noted in the corners of the screen, as well as a fair amount of image blooming as the intensity of the display was increased. In each case, the UltraSync is about average for the group.

VIVID, CRISP IMAGE Fringing of the colors around individual characters could not be detected, which, along with the extremely small dot pitch, explains why the borders between color areas on the screen are so sharp. The result was a vivid, crisp image when running *Microsoft Windows*.

The colors were better than average, with only brown and red having too little distinction between them—both were a shade too orange. Fortunately, that orange

PC MAGAZINE FACT FILE

Princeton Graphic Systems
601 Ewing St., Bldg. A
Princeton, NJ 08540
(609) 683-1660

Princeton PSC-28
List Price: $695
Requires: VGA video adapter.
In Short: This pint-size (11.6-inch) monitor offers superb brilliance and clarity in a VGA-only monitor—much better than its bargain price would indicate.
CIRCLE 686 ON READER SERVICE CARD

Princeton UltraSync EDITOR'S CHOICE
List Price: $849
Requires: Any IBM-standard video display adapter.
In Short: The 11.6-inch UltraSync's motto should be "good things come in small packages." It offers the excellent video qualities of the PSC-28 along with multiscanning capabilities. The only question is whether the screen is really large enough.
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CIRCLE 526 ON READER SERVICE CARD

■ VGA MONITORS

cast doesn't carry over to any of the other colors. They are quite accurate, and white is rendered as pure as the proverbial driven snow.

The controls on the UltraSync allow for just about every conceivable adjustment, but they aren't easy to reach. The brightness and contrast controls reside on the left side of the cabinet, the power and text mode switches on the right, and the remainder on the back. Some, like the analog/TTL switch, should need to be changed only when you're switching computers or adapter boards, but putting the size and position controls on the front would prevent the "human-pretzel" routine required to adjust them while watching the screen.

The UltraSync has a better text mode than most of the other monitors reviewed here. Pressing the text mode button cycles the characters through white, green, amber, and cyan on black, and back to color mode. The amber image is more accurate than the orange display some of the other manufacturers try to pass off as amber. One minor complaint with the UltraSync is the lack of video-blanking circuitry until the monitor syncs up with the host CPU. During a Ctrl-Alt-Del warm boot, the screen goes into a frenzy for about a half-second until it adjusts to the video output.

If you're willing to give up the multisync capabilities of the UltraSync and content yourself with a VGA-only monitor, Princeton's PSC-28 offers a display of comparable quality at a savings of over $150.

Missing from the PSC-28 are controls for adjusting the image size and position. In our tests, though, they were never needed. The image was perfectly centered, with a ⅝-inch border on all sides of the screen, and Princeton's automatic vertical-sizing circuitry handled video mode changes admirably.

In terms of video performance, the PSC-28 proved to be the UltraSync's identical twin, sharing the same crisp bright image and accurate colors.

The only reservation I have about the Princeton monitors is whether their 12-inch screens are really large enough. If you can live with that limitation, then either one is a wonderful choice as an upgrade to the world of VGA video.

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SONY CORP. OF AMERICA
Sony CPD-1303

Sony's line of Trinitron color television sets established a standard back in the '70s; hence the Trinitron label on the 13.3-inch, $825 Sony CPD-1303 filled me with great expectations. But the results of our tests produced mixed feelings. The fact that the CPD-1303 possesses colors among the very best can't make up for the coarse dot pattern and high-glare screen.

Rather than using the three-dot phosphor pattern found in all of the other monitors, Sony lays its luminous coating down in a series of repeating strips across the picture tube. This approach results in rectangular dots of surprisingly coarse pitch—0.38mm. Consequently, both text characters and graphics have a coarse quality to them. Only the IBM 8512's characters were more fractured.

The screen of the CPD-1303 is unusual in that although the horizontal axis has an average amount of curvature, it is virtually flat along the vertical line. This made for what would have been a pleasing display had it not been for the high level of glare. In the interest of maintaining sharpness, Sony has elected to forgo the usual etching, and bright light sources from behind were often quite distracting.

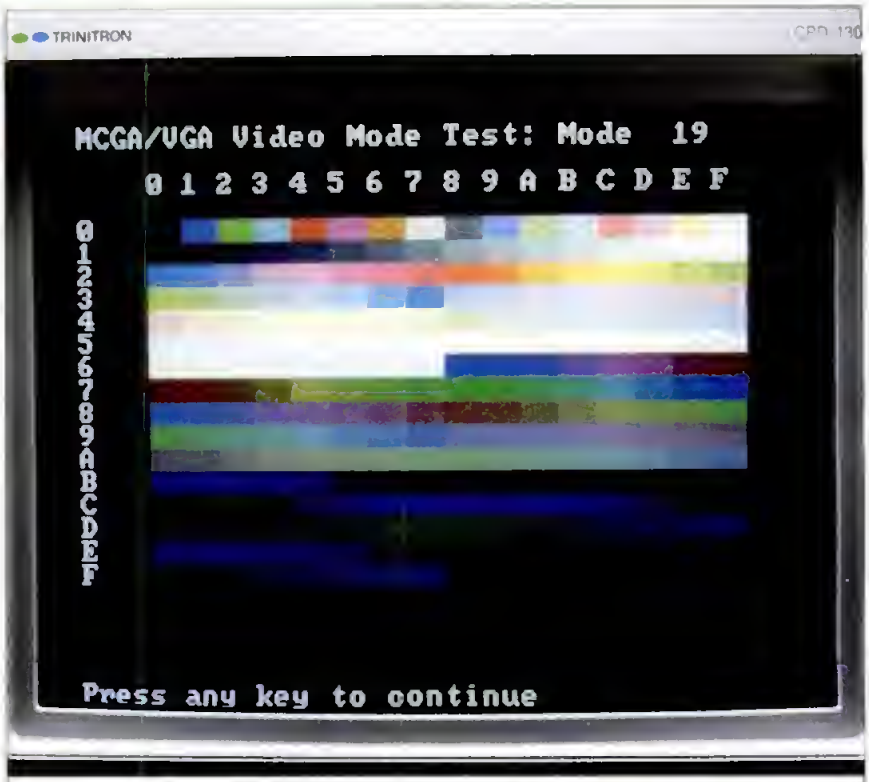
Sometimes glare can be reduced through deft manipulation of a tilt-and-swivel base, but the CPD-1303's optional base has a limited range of vertical motion and an excessive amount of friction. It could not be tipped below perpendicular to the desktop; moreover, it required two hands and a healthy shove to move it. It's bad enough that the base costs extra ($30) on an already expensive monitor, but its limitations are inexcusable.

Tirades aside, the CPD-1303 has its pleasing qualities, not the least of which is the purity of its colors, which were among the best of this group of monitors. No evidence of any pervasive tints could be detected, and the black background was the darkest of the lot. My only complaint is that the brightness level is only adequate, even with both the contrast and brightness controls at their maximum settings.

The *AutoCAD* crowd will appreciate the Sony's lack of linear distortion and minimal image blooming. These qualities also made for pleasing sessions with *Windows* applications, although the coarse dot pitch makes itself too readily apparent.

The cabinet, in typical Sony fashion, is attractively styled and a perfect match for the PS/2 computer line. On the upper-right-hand side are the controls for power, brightness, and contrast. The remaining controls live on the back under a removable panel that just invites being lost.

If Sony would sharpen the CPD-1303's



The Sony CPD-1303 is handicapped by the granular texture of its graphics and text characters due to the coarse dot pitch. The high-glare screen and limited tilt-and-swivel base cause further problems that limit the effectiveness of this monitor. Colors, however, are clean and are displayed against the darkest black background of any monitor tested here.

PC MAGAZINE FACT FILE

Sony CPD-1303
Sony Corp. of America
9 W. 57th St.
New York, NY 10019
(212) 371-5800
List Price: $825
Requires: CGA, EGA, PGC, or VGA video adapter.
In Short: What may well be the finest multiscanning colors available are countered somewhat by an overly coarse dot pitch and a bothersome polished screen (13.3-inch screen size).

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PC Magazine
Feb. 10, 1987

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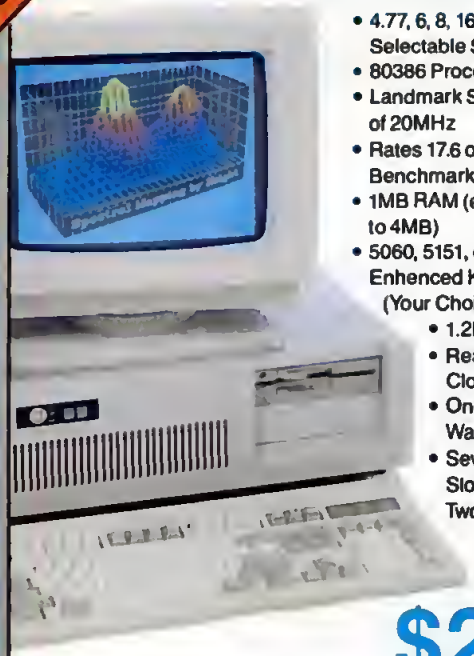

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PC Magazine, Feb. 16, 1988

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PC MAGAZINE Editor's Choice Feb. 18, 1987

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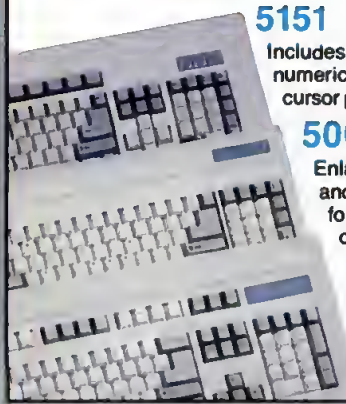

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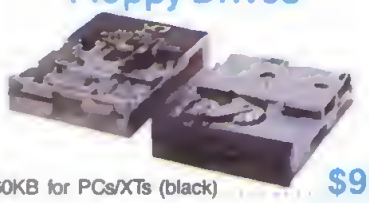

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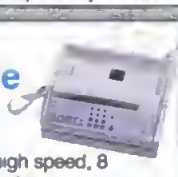

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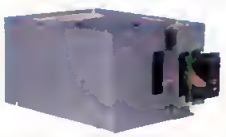

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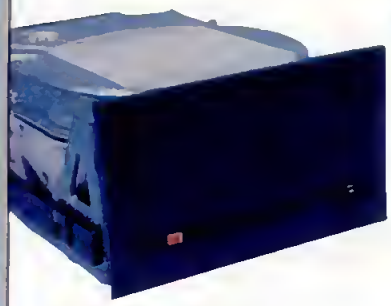

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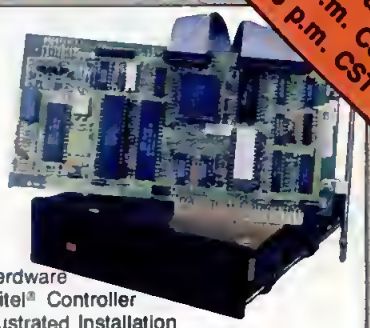

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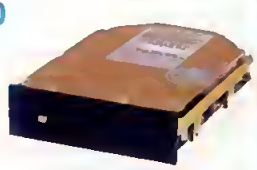

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Freelance Plus (3.5") $343
Form Tool $54
Gem Draw Plus $189
Generic CADD $50
Graph-in-the-Box $70
Harvard Graphics $279
PC Paint $53
Print Shop $34
Print Shop Companion $28
Windows Draw $189
Windows Graph $249

Organizational
Harvard Total Project Manager $367
Microsoft Project $330
Timeline $280
Timeline (3.5") $280

Spreadsheets
Enable $394
Framework $345
Javelin Plus $157
Microsoft Excel $330
Microsoft Multiplan $130
PFS: First Choice $79
Quattro (Regular Price) $123
Surpass $265
Symphony (3.5") $468
VP-Planner $55

Utilities
Copy II PC $23
DESQview $74
DESQview (3.5") $74
Disk Optimizer $39
Fastback $92
Fastback Plus $95
Fastback Plus for PS/2 & Laptops $95
Gofer $40
Mace Utilities $50
Microsoft Windows $66
Microsoft Windows 386 . . . . . $130
Norton Utilities Advanced Edition $79
PC-FullBak $49
PC Tools Deluxe $40
SideKick $50
Sideways $40
SQZ! Plus $57
XTREE $35

Word Processors
Bank Street Writer Plus $45
Gramatik II $50
Microsoft Word $229
MultiMate Advantage $269
Network Word $100
PFS: Professional Write $115
Q&A Write $106
Websters New World Combo $51
Webster New World Professional Thesaurus $40
WordPerfect (Regular Price) . $215
WordPerfect (3.5") $214
Word Perfect Executive $110
WordStar Professional $239
WordStar 2000+ Personal . . $279

dot pattern, etch its screen, and design a better base, it would have a winner. As it stands now, the CPD-1303 is only an average VGA multiscanning monitor.

TATUNG CO. OF AMERICA
Tatung CM-1495

Tatung's $875 CM-1495 is something of a textbook case in mediocrity as multiscanning VGA monitors go—it doesn't have any distinctly undesirable aspects, yet there is nothing about it that is particularly endearing, either.

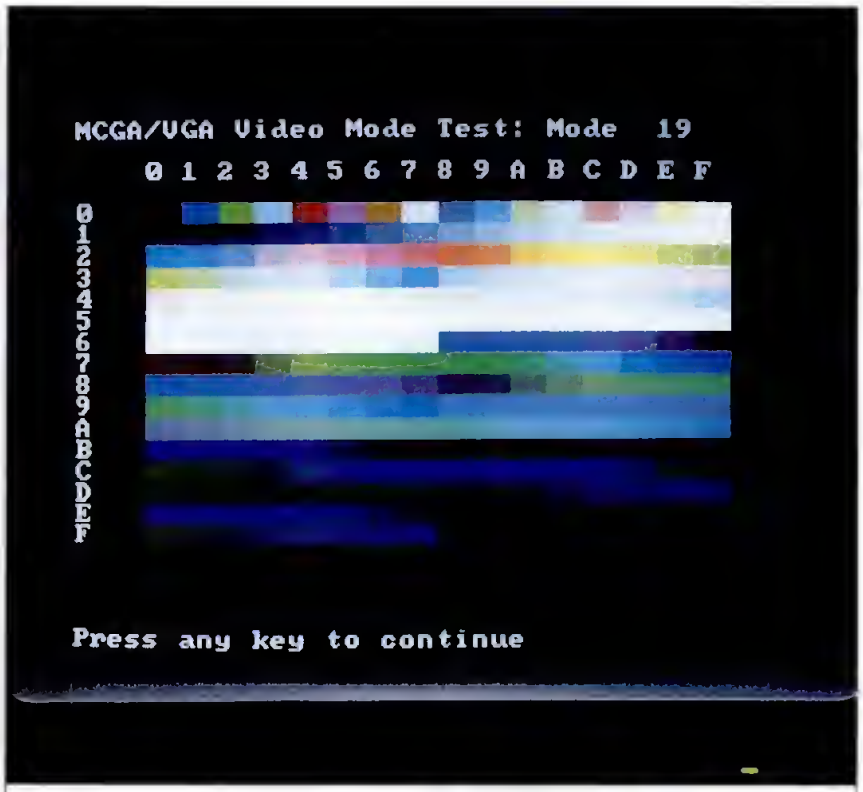
Color images on this 13-inch, 800- by 560-pixel-resolution monitor are generally crisp and bright, but not altogether accurate. Brown tends a bit toward burnt umber, while yellow is somewhat washed out and, consequently, looks more like the canary shade used in multipart forms.

Though the complete absence of linear distortion and overall sharpness would seem to invite use with CAD/CAM software, the CM-1495 is marred by the worst image blooming of any monitor we tested. Indeed, as the brightness levels in the PC Labs benchmark test ran from lowest to highest luminosity, the image grew by nearly ½-inch diagonally on the screen.

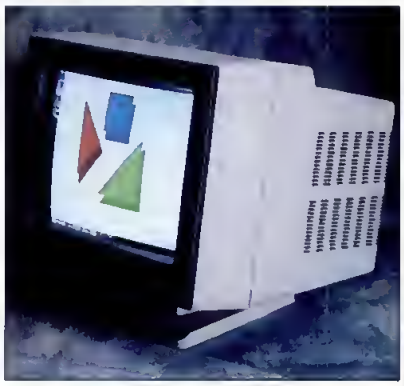
On a positive note, the Tatung's character display is sharp, with seemingly perfect alignment of the color guns to the screen's dot pattern. Reduction in sharpness did occur as the brightness level was increased, but not until it had reached a brilliance not likely to be needed in the average setting. The view when running applications under *Windows* was among the best.

On the top of the reasonably attractive cabinet is a small door hiding the controls for horizontal and vertical size adjustment and position, brightness, and contrast. The door is secured by a plastic hinge molded integral with the case and will probably break in time. This could be a problem if you should choose to switch between VGA and CGA-emulations modes often, since the lack of automatic vertical size adjustment results in a vertically squashed image in CGA mode when the monitor is otherwise set up for VGA images. Your only recourse is to resort to the manual vertical size control. And you had better not have large fingers, because the controls are far too small for even average-size digits to manipulate easily.

On the rear of the housing are controls for power and a rotary switch for selecting between 8, 16, 64, and "auto" color se-



The Tatung CM-1495 is a monitor that is exceptional only for its mediocrity. The effect of the sharp character display and well-aligned color guns is diluted by poor image blooming and an awkwardly designed cabinet that makes it difficult to reach the controls. If you need more than just a VGA display, this monitor is not the best choice.



FACT FILE

Tatung CM-1495
Tatung Co. of America
2850 El Presidio St.
Long Beach, CA 90810
(213) 979-7055
List Price: $875
Requires: Any IBM-standard video display adapter.
In Short: Although the 13-inch CM-1495 is an average-performing monitor as a color display, its text-mode switch should best be forgotten. The odd hues in text mode beg for a return to full color.

CIRCLE 685 ON READER SERVICE CARD

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* March 10, 1987 issue, page 278

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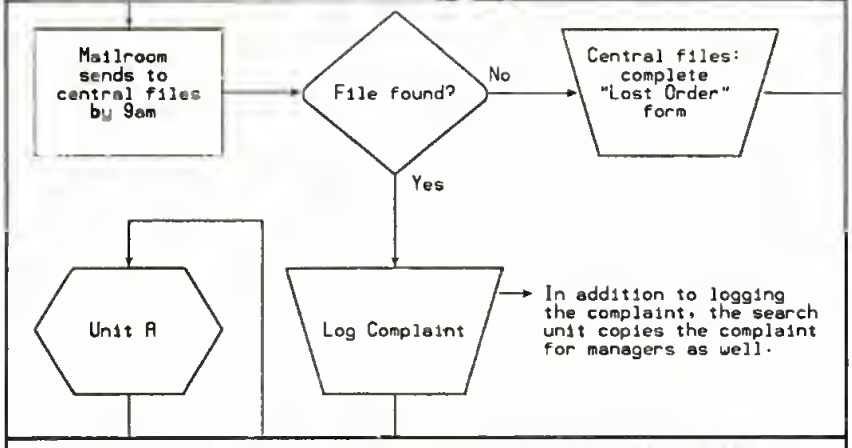

The chart fragment above was produced on an HP LaserJet-Plus and is actual size and unretouched. Publication quality charts like this can be produced using only minutes of preparation time and seconds of print time.

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■ VGA MONITORS

PC MAGAZINE EDITOR'S CHOICE

- **Electrohome 1310U**
- **NEC MultiSync II**
- **Princeton UltraSync**

Ignore for the moment that Electrohome's name sounds like a fifties advertisement for trash compactors, because its multiscanning 1310U is one of the very best VGA monitors available. Its image is crisp and bright, and its cabinet looks so much at home with the PS/2 Model 80 that one wonders if it wasn't actually designed by IBM.

NEC has a well-deserved reputation for building high-performance monitors for just about every application, and its MultiSync II follows in those footsteps. With an image virtually equal to that of the Electrohome 1310U, it is also an outstanding choice.

Although a bit smaller than the others, Princeton's UltraSync offers exceptional luminosity and clarity. And with street prices hovering around $500, it's also clearly something of a bargain.

lections. With a VGA video adapter, the use of this switch isn't required.

Much like the Nanao FlexScan, the Tatung CM-1495 has a text mode switch that doesn't quite live up to its name. It selects between green or amber on black, as well as white on dark blue, but only the green mode is satisfactory, resulting in all non-white characters being displayed as clean shades of green. In the other modes, some of the original colors bleed through to result in combinations of odd hues.

For strictly VGA displays, and especially for *Windows* applications, the CM-1495 leaves little to be desired. But when venturing into the uncharted waters of emulation of other, earlier modes, or pretend-monochrome, it comes up short.

Frank Bican is a contributing editor of PC Magazine.

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material

MAKING CONNECTIONS

TOPS

Looking for a connectivity solution to take care of your network's PC, Mac, and UNIX-based-machine incompatibilities? Here we describe the ways in which the TOPS network could be your best choice.

FRANK J. DERFLER, JR., AND ROBERTO RIVERA

All major companies in the local area network arena acknowledge their need to "do something" for the Apple Macintosh products. Macs are now viewed as legitimate corporate tools, after all. And their potential ability to share data and printers with PCs and other systems bolsters their value even more.

It is for this reason that the latest version of TOPS, a combination interface cards/software package (from the company of the same name), has been proving its mettle in doing just that: inter-environment data sharing. Although compatibility with all networks is still on the drawing board, this LAN features capabilities to connect, physically and logically, IBM and compatible personal computers, Apple Macintoshes, and UNIX-based machines into one integrated network.

TOPS acts as a standardized environment. And it provides file access protocols that are universal among these systems. It tackles the problem of incompatibility by translating local requests of a certain machine's operating system into a request recognized by the *TOPS* software in any machine on the network.

MIX 'N' MATCH NETWORKING Permitting the sharing of both files and peripheral devices, TOPS can link up to 32 computers on a network. This network can also be bridged with other networks, mixing any of the supported computers. For each machine type, TOPS provides a specialized software that allows the machine to run on the network: IBM PCs and compatibles use *TOPS/DOS*,

Apple Macs use *TOPS/Macintosh*, and UNIX machines use *TOPS for Sun Workstations*.

If you use a PC or compatible, your applications use TOPS to access data stored on another PC or on a Macintosh. You can refer to a Mac's drive just as you would a floppy or hard disk drive on your own PC. If you are using a Mac, PC volumes appear on the Mac screen as disk icons, as if they were stored on the attached drives of the Macintosh.

Let's say that you, at a PC-DOS workstation, want to edit a word processing document prepared and residing on a Macintosh. To begin, your PC's own word processing program makes a file access call to DOS. The call doesn't make it: it's intercepted by the RAM-resident TOPS command interpreter, translated into a TOPS call, and then relayed via the network to the Macintosh.

In the Mac, the *TOPS* program passes the file request to Finder, the Mac's command interpreter. Finder responds, and the *TOPS* software (on the Mac) converts the response from the Mac application format into a preselected format for a DOS application. The *TOPS* software then passes the converted file through the network to your PC-DOS workstation and on to your word processing program. Throughout, the process is performed completely in the background, transparent to all users.

In addition to file-sharing networking activities—or even as a separate standalone function—people with IBM PCs can use the Apple LaserWriter on a TOPS network through a separate product for PCs called *TOPS Netprint*. *TOPS Netprint* enables IBM-type PCs to print directly to Apple LaserWriters. The *TOPS* networking software is not needed, but a TOPS FlashCard (network interface card) is required in the PC.

TOPS is a peer-to-peer network, meaning that any workstation can share or use any other workstation's files and devices. The latest version, TOPS 2.0, lets any station on the network make an attached printer available to the network. Peer-to-peer file sharing does have its benefits, as the distributed architecture provides a degree of fault tolerance. But time-sharing of a processor among local processing tasks and the network often results in diminished performance for both operations.

LONG TIME COMING The technology of TOPS is not new, but it took time and the efforts of both Apple and other manufacturers to earn it a place as a viable LAN alternative. The Macintosh's designers first showed an interest in Mac networking ability when they began installing an integral interface port into the newer slotted Macs—as they had been doing for the Mac Plus and Mac 512. This port, called AppleTalk, hooks into a network that uses a carrier-sense-multiple-access media-sharing protocol over plain telephone wire.

AppleTalk's initial role, according to Apple's plan, was to connect the Mac and an Apple LaserWriter. Apple took years to deliver file server and workstation software, along with the network hardware needed to make AppleTalk into a true network providing file access services.

But when Apple hesitated in attaching Apples to a real network branch, other companies moved in. 3Com made Apple networking capabilities an intrinsic part of its 3Server products. Hayes now markets a repeater to link AppleTalk networks. Kinetics sells a device that links AppleTalk

FACT FILE

TOPS
TOPS
950 Marina Village Pkwy.
Alameda, CA 94501
(415) 769-9669
List Price: TOPS/DOS, Version 2.0, including software and the TOPS FlashCard, $428; TOPS FlashCard sold separately for use with *TOPS Netprint*, $239; *TOPS Netprint*, $189.
In Short: TOPS is a LAN system with particular capabilities to link PC and Macintosh computers and printers. It lacks the speed and features of many PC-to-PC connectivity alternatives, but it does an excellent job of Mac-to-PC integration. *TOPS Netprint* enables IBM-compatible PCs to print directly to Apple LaserWriters via AppleTalk connections. The *TOPS* networking software is not needed, but a TOPS FlashCard is. The PhoneNet Connector for connecting to AppleTalk is sold by Farallon Computing, 1442A Walnut St., Berkeley, CA 94709; (415) 849-2331.

CIRCLE **683** ON READER SERVICE CARD

The Connectivity Decision Guide

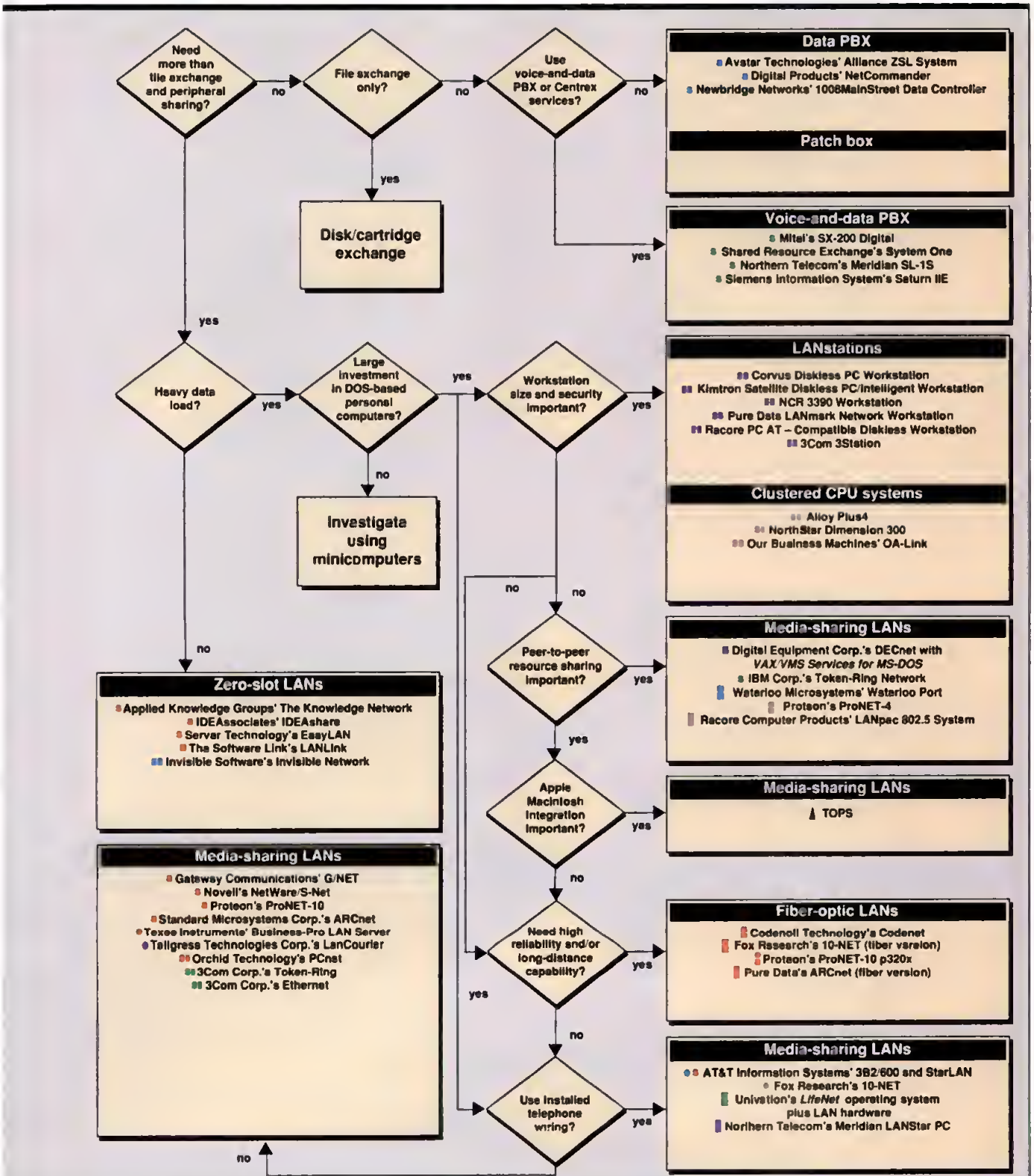
This chart is designed to help you select from among the many information-transfer and resource-sharing alternatives. As you can see on the chart, if all you really need to do is exchenge files or share printers, then you should consider devices such as PBXs and patch boxes. If your orgenization has not already invested heavily in PCs or DOS programs, then a minicomputer might meet your needs more economically. But if you want many users to share data files simultaneously under DOS, a LAN may be the best alternative. Once you've decided on a LAN, the need for station-to-station resource sharing and other factors will influence your network purchasing decision.

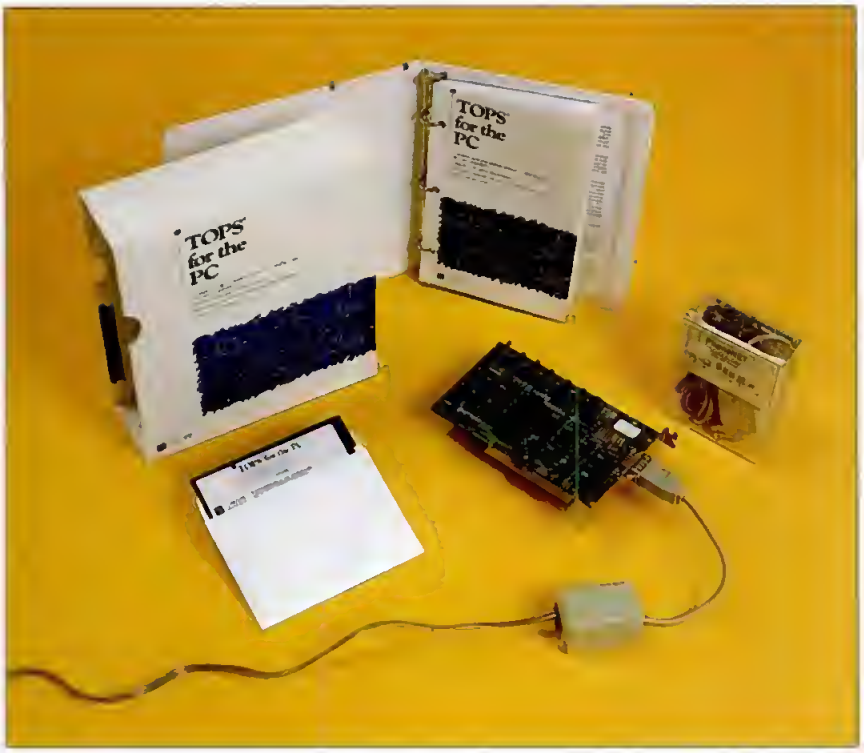
Because manufacturers include many different features in their networks, some products will not fit neatly into one decision box in this guide. You'll also find that the lack of differentiation between LANs is becoming as large a problem in the LAN industry as the lack of standards was 2 years ago. But overlapping features and technical similarity between networks are good news for potential buyers. They will let you concentrate on more-traditional factors such as dealer support and price instead of on more-technical considerations.

Reviews originally appeared in *PC Magazine:*

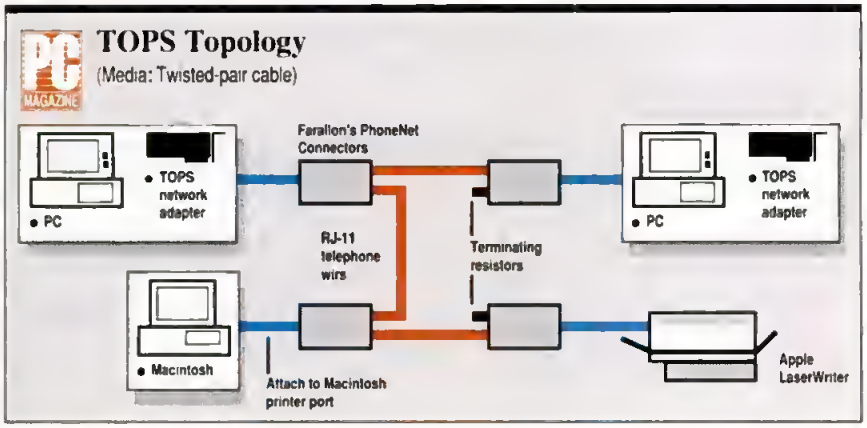
- **December 9, 1986**
- **December 23, 1986**
- **January 13, 1987**
- **January 27, 1987**
- **February 10, 1987**
- **February 24, 1987**
- **March 31, 1987**
- **April 14, 1987**
- **May 26, 1987**
- **June 9, 1987**
- **June 23, 1987**
- **July 1987**
- **August 1987**
- **September 29, 1987**
- **October 27, 1987**
- **January 12, 1988**
- **January 26, 1988**
- **February 16, 1988**
- **March 29, 1988**
- **April 26, 1988**
- **May 31, 1988**

Black marker indicates current issue.


Need more than file exchange and peripheral sharing?
no
File exchange only?
no
Use voice-and-data PBX or Centrex services?
no
yes
Disk/cartridge exchange
yes
Data PBX
Avatar Technologies' Alliance ZSL System
Digital Products' NetCommander
Newbridge Networks' 1008MainStreet Data Controller
Patch box
Voice-and-data PBX
Mitel's SX-200 Digital
Shared Resource Exchange's System One
Northern Telecom's Meridian SL-1S
Siemens Information System's Saturn IIE
yes
Heavy data load?
yes
Large investment in DOS-based personal computers?
yes
Workstation size and security important?
yes
no
Investigate using minicomputers
LANstations
Corvus Diskless PC Workstation
Kimtron Satellite Diskless PC/Intelligent Workstation
NCR 3390 Workstation
Pure Data LANmark Network Workstation
Racore PC AT – Compatible Diskless Workstation
3Com 3Station
Clustered CPU systems
Alloy Plus4
NorthStar Dimension 300
Our Business Machines' OA-Link
no
no
no
Zero-slot LANs
Applied Knowledge Groups' The Knowledge Network
IDEAssociates' IDEAshare
Server Technology's EasyLAN
The Software Link's LANLink
Invisible Software's Invisible Network
Peer-to-peer resource sharing important?
yes
Media-sharing LANs
Digital Equipment Corp.'s DECnet with VAX/VMS Services for MS-DOS
IBM Corp.'s Token-Ring Network
Waterloo Microsystems' Waterloo Port
Protean's ProNET-4
Racore Computer Products' LANpac 802.5 System
yes
Apple Macintosh integration important?
yes
Media-sharing LANs
TOPS
Media-sharing LANs
Gateway Communications' G/NET
Novell's NetWare/S-Net
Proteon's ProNET-10
Standard Microsystems Corp.'s ARCnet
Texas Instruments' Business-Pro LAN Server
Tallgrass Technologies Corp.'s LanCourier
Orchid Technology's PCnet
3Com Corp.'s Token-Ring
3Com Corp.'s Ethernet
no
Need high reliability and/or long-distance capability?
yes
Fiber-optic LANs
Codenoll Technology's Codenet
Fox Research's 10-NET (fiber version)
Proteon's ProNET-10 p320x
Pure Data's ARCnet (fiber version)
yes
no
Use installed telephone wiring?
yes
Media-sharing LANs
AT&T Information Systems' 3B2/600 and StarLAN
Fox Research's 10-NET
Univation's LifeNet operating system plus LAN hardware
Northern Telecom's Meridian LANStar PC
no



You can use TOPS to link together PCs, Apple Macintoshes, and the Apple LaserWriter. Our tested system was connected using PhoneNet Connectors linked with the flat RJ-11 wire commonly used to connect a telephone to the wall jack. The PhoneNet Connectors attach to the TOPS interface cards in the PC and to the built-in AppleTalk ports in the Apple products.



and Ethernet. And both Novell and DEC announced methods of integrating at least the slotted Macs into their networks.

With all this activity, still there remained a void. In stepped Centram Systems with Mac networking software, followed by its move to connect both PC and UNIX users to the considerable resources of the Macintosh line. Centram was acquired by Sun Microsystems in early 1987, when it changed its name to simply TOPS. With Sun Microsystems in the business of providing connectivity products for multivendor systems, the Centram acquisition filled an important gap in the company's Open Systems Networking strategy.

Important as it is, however, TOPS's combination of programs and interface cards are not all things to all networks—depending upon configuration.

One limitation is that the TOPS network interface cards for the PC can work only with the *TOPS* software. There's no capability to use NETBIOS as a standard interface between the interface card and other network operating systems.

But the *TOPS* software does work with several PC network interface cards designed by the manufacturer for compatibility. These include a new Hercules card called Network Card Plus (combining Hercules monochrome graphics and networking), the TandyLink card distributed by Tandy Computers, and Apple's own AppleTalk card for the PC.

TOPS NETWORKING SOFTWARE

The *TOPS* networking software consists of many modules that intercept certain DOS calls, redirect them out through the network, and answer requests for services coming in through the network. Some modules provide an optional menu of services to the users. Others accept inputs from the DOS command line or batch files. A background print-queuing module holds printing jobs until the networked printer is ready to accept them.

Several modules become memory resident in every networked station and take about 192K RAM away from applications in a PC workstation. Keeping these programs in memory lets them operate nearly invisibly in the background mode. But if loss of RAM will be a problem, TOPS offers a way around it through use of the $249 (minus 10 percent discount) HIcard provided by RYBS Electronics. In a typical installation, the HIcard makes 629K RAM available for DOS and applications.

For advanced users and for the automation of TOPS instructions through batch files, TOPS provides a command-line interface. TOPS commands are prefixed by the word TOPS followed by the command. The command interpreter, TOPS .EXE, is activated when the word TOPS followed by a command and its parameters are entered on the command line.

And for end users, TOPS provides an interface called TOPSMenu, which consists of a series of menu and submenu options to manipulate the TOPS system and

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CIRCLE 103 ON READER SERVICE CARD

contains all the functions in the command-line interface. The main menu is divided into Client and Server options. By TOPS nomenclature, a Client is a station using a volume (directory or subdirectory) published (made available for sharing) by another station. A Server station has made files on its disk drive public, or available to the network.

Using the Client submenu, you can list the available servers on the network, list the volumes published on a server, attach to a volume so that it becomes a virtual disk drive, choose an access mode (read-only or read/write capabilities), and detach from a volume.

On the Server submenu, you can list directories on a drive, publish a directory to the network, list clients attached to your networked drive, make portions of a drive unavailable, change a password, and other functions. Through the menu system, the *TOPS* software allows addressing designated files with an alias (usually a meaningful title like Receipts) instead of forcing people to know path- and filenames.

EASING TRANSLATION WOES Ordinarily, under DOS you can't use a DOS file created under *Lotus 1-2-3* in *WordStar* unless you take special actions to use a common file format such as ASCII. The same limitations exist in moving files between DOS and Finder applications; without translation, files in only a few standard formats can move between applications on PCs and Macs. Ashton-Tate, WordPerfect, Aldus, and Microsoft make versions of their application programs with common file structures in DOS and Finder. Without such accommodation, you need a way to convert file formats.

A program module (now part of *TOPS/Macintosh*) called TOPS Translators, developed by DataViz, runs in the Mac and translates file formats between popular applications used on the Mac and the PC. The TOPS Translators work on files in the unique formats used by *Microsoft Excel*, *Lotus 1-2-3*, *Jazz*, *Multiplan*, and *Lotus Symphony* spreadsheets. We exchanged files between *MacWrite* and *WordStar*, and they showed up with appropriate underline, boldface, and formatting commands on both ends of the link.

If your network doesn't have a Mac, TOPS is easy to install as a functional basic network for PC-to-PC networking. TOPS isn't as expensive or difficult to maintain as some of the PC-to-PC networking alternatives. But keep in mind that it isn't as fast as many alternatives, either. Moreover, TOPS lacks the electronic mail, calendaring, security, and administrative features found in competing PC-only products such as 10-NET. If these kinds of features are more important to you than PC-to-Mac connectivity, you might look at other networking alternatives.

ENABLE LAN.

Put Enable 2.0's LAN version to work and you have the most useful, powerful network software on the market. With Word Processing, Spreadsheet, Graphics, Database Management and Telecommunications rivalling the functionality of the best stand-alones. In an *Infoworld* side-by-side comparison of all integrated LANs, Enable/LAN came out on top "...Easier to learn and use... the best integration... [Enable] simply feels right."

EXPLORING TOPS HARDWARE The AppleTalk bus provides a good method of connecting to Apple's hardware. All of the newer Macs and LaserWriters have it, and a company called Farallon Computing makes an adapter that brings the AppleTalk bus out to connect with standard chassis plugs and jacks.

It's possible to get confused here, with Farallon calling its connection scheme the PhoneNet Connector, not AppleTalk: The PhoneNet is actually Apple's AppleTalk implemented on easily installed RJ-11 telephone wire and connectors. Together, Farallon and TOPS extend the AppleTalk topology and bus-access scheme beyond the Apple product line. And by the time you read this, TOPS should have its own products, called Teleconnectors, available as a telephone-wiring interface.

The TOPS network interface card for the PC, the FlashCard, is a half-size card with six jumpers that set different I/O addresses, interrupts, and DMA (direct memory access) channels. Under most conditions the factory settings of the interface card need not be changed, but in case of conflicts the card configuration is changed by resetting jumper settings.

The card features a 9-pin jack that attaches to the plug coming from Farallon's PhoneNet Connector. The Farallon connector consists of two RJ-11 jacks that attach to the twisted-pair telephone wire and a pigtail lead for the 9-pin plug. Inside the connector are some equalization resistors and an impedance-matching transformer. These parts route the signals from the 9-pin interface to the dual-pair telephone wire used in AppleTalk.

The AppleTalk standard specification, supported by all the Apple hardware, calls for a data rate of 236 kilobits per second. Considering that StarLAN, which is one of the slowest of the media-sharing network interfaces, is rated at 1 megabit per second, AppleTalk "speaks" slowly.

In networks equipped only with TOPS cards, the newest versions of the *TOPS* software increase this data rate to 770 kbps. This technique gives better throughput, but it isn't AppleTalk. Version 2.0 of TOPS includes a software driver and networking hardware, enabling a PC to communicate with Macs at 236 kbps and then to automatically switch to 770 kbps for PC-to-PC communications.

INSTALLING TOPS There are three major steps involved in installing TOPS, all relatively simple. The first is hardware installation; the second is file installation; the third, software configuration. In the third step—the one requiring the most care and planning—determine which files and devices are shared with the network, name them, determine security rights, and access the shared resources.

Because the PhoneNet system uses the

UNABLE LAN.

No matter what the alternative, there's every good reason to plug into Enable's ease, speed and impressive capabilities. *PC Week* called Enable 2.0, "Best integrated software package on the market." *PC Magazine* wrote, "Enable is everything Symphony hoped to be." And you'll agree with *Personal Computing* that, of all integrated software, "this is the one program to seriously consider." For more information, plus the name of your nearest Enable dealer, just dial 1-800-634-3470. New York: 1-800-551-1004. Canada: 1-613-727-5040. Ask for Dept. M.

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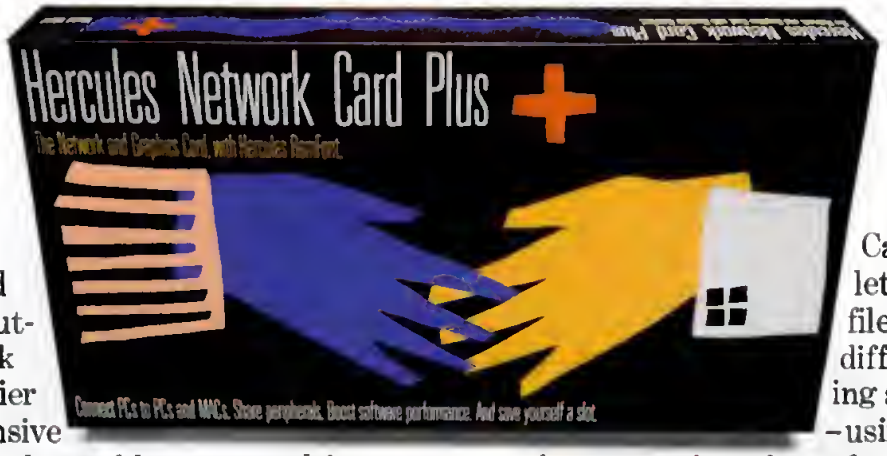
Network Card.



The new Hercules Network Card Plus makes putting a network into place easier and less expensive than most people would have thought possible.

But there's something else about the Network Card Plus that makes it even better.

It's also an advanced graphics card with Hercules' proprietary RamFont technology.

And since the Network Card Plus puts both graphics and network capabilities onto a single card, it saves you a slot – at the same time that it saves you money.

As a network card, the Network Card Plus lets you connect PCs to other PCs, to Macintoshes, and to UNIX based systems, quite easily and inexpensively. It lets you share costly resources such as laser printers. All via the AppleTalk network protocol.

The Network Card Plus also lets you share files – even across differing operating systems – using the normal interface of whichever machine you access those files with.*

Once your network is up, it's easily expandable – so you aren't limited to the configuration you start with. You can add a peripheral or a computer whenever you wish. A network can include up to 32 nodes – or more if you link networks.

Of course, the Network Card Plus is also rather

*User must provide inexpensive networking software, such as TOPS/DOS © 1988 Hercules Computer Technology, Inc., 921 Parker Street, Berkeley, California 94710.
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Hercules Network Card Plus, TOPS DOS 2.0 Software and Farallon Connector

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RamFont gives you tremendous variety in character styles and sizes, and radically increases the functionality of a great many software products.

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In short, the Network Card Plus is just as advanced a graphics card as it is a networking solution.

It can be had at much less than the cost of buying cards for each job.

And all of this makes the Network Card Plus a single card that can quite affordably answer the computing needs of today.

And those of tomorrow. For more information on the Network Card Plus and where you can buy it call toll-free 1-800-532-0600 ext. 404 (U.S.) or 1-800-323-0601 ext. 404 (Canada).

Hercules Network Card Plus

The easiest way to put a network into place is with a graphics card.

Benchmark Tests: TOPS

TOPS is anything but fast. Its slow transmission media and peer-to-peer resource sharing are designed for low-cost flexibility rather than speed. TOPS works well for desktop-to-desktop file transfers and printer sharing, and it's the best choice for Macintosh-to-PC networking, but we can't recommend it for multistation DBMS work or for heavy communications gateway activity.

Performance Times

(Times given in seconds)

Network Speed Under Load

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations
8-MHz IBM PC AT	TOPS FlashCard	*TOPS*	1,137	1,172	1,239	1,354	1,577
3Com 3Server3	EtherLink	*3+Share*	306	432	529	651	761
8-MHz IBM PC AT	EtherLink	*Advanced NetWare/286*	264	280	301	310	322

Hard Disk Access Load

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations
8-MHz IBM PC AT	TOPS FlashCard	*TOPS*	636	1,209	1,446	1,919	2,643
3Com 3Server3	EtherLink	*3+Share*	155	227	330	419	522
8-MHz IBM PC AT	EtherLink	*Advanced NetWare/286*	136	150	162	174	182

Database Load

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations
8-MHz IBM PC AT	TOPS FlashCard	*TOPS*	636	648	801	1,068	1,146
3Com 3Server3	EtherLink	*3+Share*	155	298	425	585	669
8-MHz IBM PC AT	EtherLink	*Advanced NetWare/286*	136	169	212	280	305

The PC Labs LAN benchmark tests are written in C and are independent of commercial software. We ran the tests on a test-bed of four 8-MHz IBM PC ATs. For our test-bed to better simulate the conditions on a medium-size network of 20 or more workstations, we have designed these loading tests so that a single station represents five to ten times the load of a user performing an interactive task (for example, updating records) on a network.

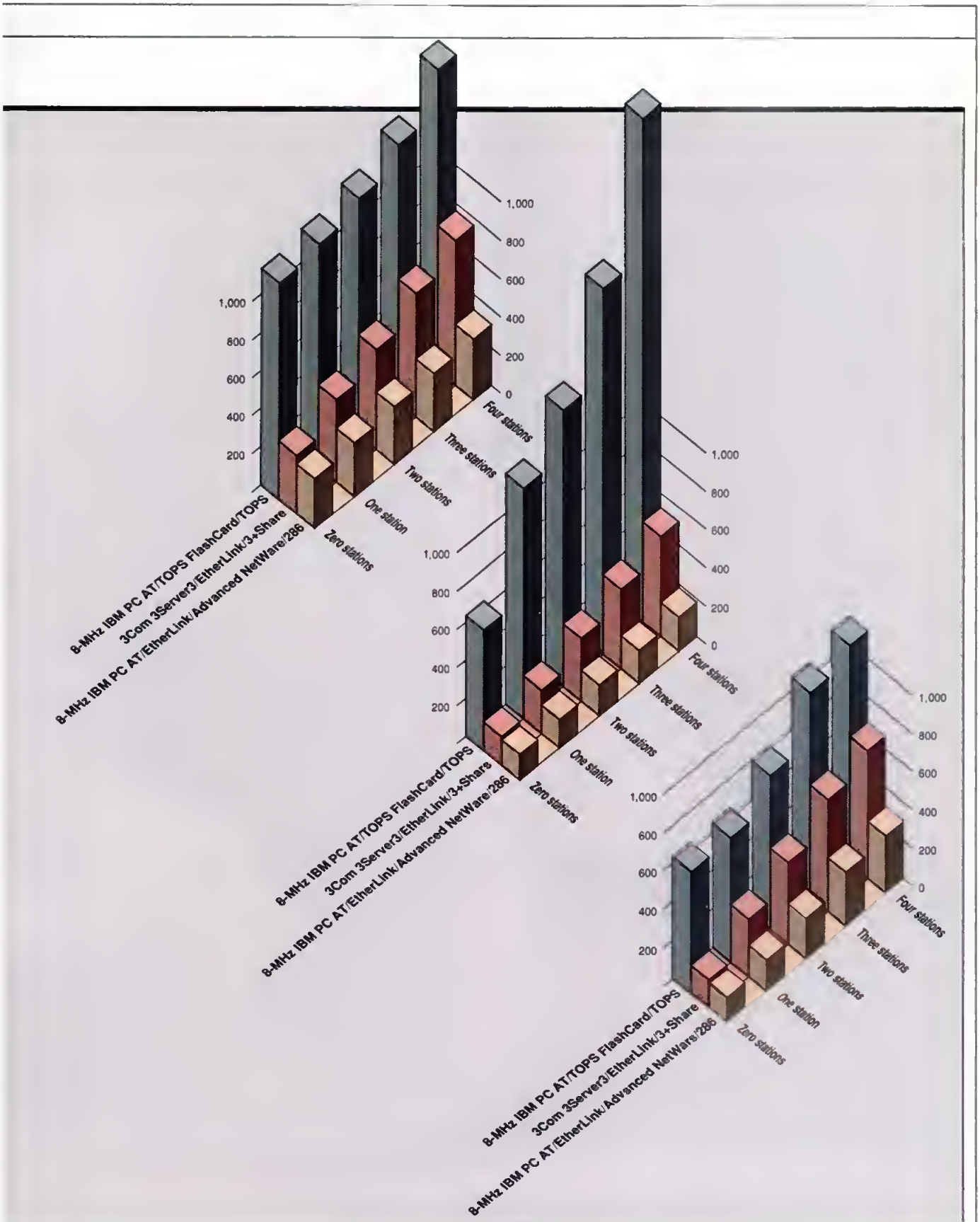
By themselves, the elapsed times reported in these tests are not meaningful. They are valuable only when used to compare the performances of two or more systems running under near-identical conditions. Accordingly, we include the tests run on our Editor's Choice configuration of a 3Com 3Server3, *3+Share* software, and EtherLink interface cards to provide a point of comparison. We also show results from a network of Novell's *Advanced NetWare/286*, EtherLink cards, and an IBM PC AT as the server. *Advanced NetWare* is our Editor's Choice for networking software, and our tested configuration is a typical one.

The **Network Speed Under Load** and the **Hard Disk Access Load** benchmark tests measure the time needed to perform a standardized task on the network. While the actual work loads used for these two tests (described below) are different, we used the same procedure for both. To obtain the elapsed times shown here, we ran a benchmark program performing a sequential create, a sequential read, a sequential write, a random read, and a random write of a large file. The record sizes used in these activities systematically rotate between 16K, 4K, and 512 bytes. The numbers shown in the three-dimensional chart are the total time necessary for all of these operations. We ran the test on all our ATs to load the network while timing just one of them. We then reduced the number of workstations one at a time to show the effect of loading on the network.

The **Network Speed Under Load** test puts a heavy load on the network interface (cards, media, and so forth) while placing a minimal load on the hard disk by having each station continuously read and write its own 1-byte data file, changing the data each time. For systems with disk caching, the load on the hard disk is even smaller, since cached systems typically perform a disk write but do not require a physical disk read.

The **Hard Disk Access Load** test heavily loads the hard disk and disk-caching system. To do this, each station randomly accesses its own 100K data file using 1K records. Data written to the file is changed each time. The random reads typically access data outside the cache, which forces a disk read, as does any write.

The **Database Load** test exercises the system's record-locking support and the way it handles a number of random simultaneous accesses to a common file. This test times how fast each loading station accesses a common database consisting of an index and a data file. Half the accesses are simple searches of the index file and an accompanying access to a record in the data file. One quarter of the accesses perform the same operation but also lock the data record and update its contents. The remaining accesses update the index file and a data record. The index file is locked during every update and the DOS 3.1 RLOCK statement prevents simultaneous index file updates.


1,000
800
600
400
200
0
Four stations
Three stations
Two stations
One station
Zero stations
8-MHz IBM PC AT/TOPS FlashCard/TOPS
3Com 3Server3/EtherLink/3+Share
8-MHz IBM PC AT/EtherLink/Advanced NetWare/286

same RJ-11 connectors used to connect modem telephones, installing it in most office environments is a matter of snap and click. The system works with wire runs of over 3,000 feet, so it's practical to use wire installed in the walls and routed through wiring closets. In small office areas, you'll probably connect computers together with telephone extension cables running next to the baseboard and under the rug.

Installing the program files is as easy as typing A:INSTALL. TOPS's installation program creates a TOPS subdirectory on the target drive (either floppy or hard disk) and copies all the files from the distribution disk. It modifies the DOS CONFIG.SYS file, adjusting the FILES and BUFFERS statement and adding the necessary device drivers. Finally, it modifies the AUTOEXEC.BAT to set a path to the TOPS subdirectory and load the RAM-resident TOPS command interpreter.

Deciding what directories and devices to share is more difficult and can be done through either the menu or command-line prompts. Typically, end users with an understanding of the network choose to use the menu system; its latest version also does a good job of showing available printers. Less-sophisticated users have the options set for them by the system administrator through batch files.

The security scheme in TOPS isn't elegant, and it proves more effective against operator errors than determined attempts at access. You can optionally attach a password to the files you make available to the network, specifying whether users have only read or both read and write privileges. The Department of Defense wouldn't keep classified data on TOPS: it's primarily a simple office network system.

TOPS isn't fast—the architecture is designed for flexibility and simplicity, not speed. The manual points out that the transfer rate of 230 kbps is 200 times faster than that of a 1,200-bit-per-second modem. But this rate hardly remains the same with up to 32 stations trying to share the bandwidth of one modem.

If you want to do a lot of DBMS work over the network, we don't recommend using TOPS. If you want to use a 3270 LAN gateway, there are better connectivity alternatives. But if you want to exchange files among PC, Mac, and UNIX workstations, integrate a PC into a predominately Mac network, or give PCs easy access to Apple LaserWriter products, TOPS is an excellent alternative.

TOPS isn't the promised LAN, but for DOS-loving Adams and Eves who want to take a byte out of an Apple, the system is close to Eden. PC

Frank J. Derfler, Jr., is a contributing editor of PC Magazine. *Roberto Rivera is a project leader in the* PC Magazine *Connectivity Labs.*

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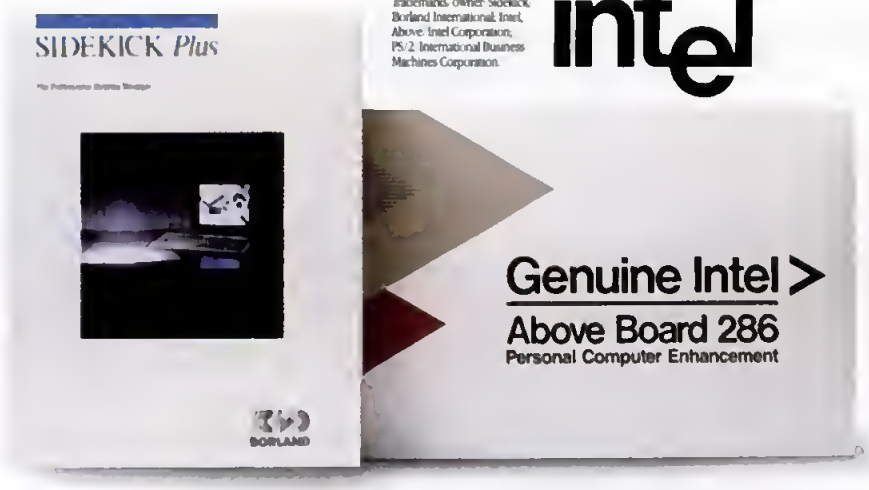

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THREE 386s: STRETCHING PERFORMANCE AT 16 MHz

These days the world is changing so fast that the Book of Life comes in a loose-leaf edition, delivered complete with several shrink-wrapped (and contradictory) updates. Nowhere is the headlong rush of progress more evident than in the area of high-performance personal computing. From 8 to 12 to 16 to 20 MHz, clock speeds and processing power have jumped to new and higher standards.

Mitsubishi, Wyse Technology, and Zenith join the 16-MHz 386 market with high-end models sporting quality engineering and unique features.

The crown worn by the power users' standard has quickly passed from IBM's now veteran and venerable AT to Compaq's Deskpro 386. Not only has the Deskpro 386 earned its regal robes as the top-selling 80386-based computer, but it has also become the standard of comparison in any examination of data processing horsepower.

ON BENDED KNEE This new trio of 80386-based PCs—the Mitsubishi MP 386, the WYSEpc 386, and the Zenith Z-386—pays homage to the accepted royal order of succession. Although each of the threesome has its own personality, all achieve the same performance level—that set by the original 16-MHz Deskpro 386. They also show that PC manufacturers are no longer content to slap a microprocessor onto a motherboard indiscriminately, cram some RAM on next to it, and call it a computer. Performance-hungry PC users won't buy that. Consequently, Mitsubishi, Wyse, and Zenith have resorted to some creative engineering to cut memory-imposed microprocessor wait states and equal the Compaq Deskpro 386 performance level.

Part of that design creativity is reflected in the absence of the common generic-computer chip sets, like the one from Chips and Technologies that so many manufacturers use to speed their design and manufacturing processes. These three 80386-based PCs constitute wholly new machines, not clones hashed together from someone else's parts.

Moreover, reflecting a growing trend in the industry, two of these machines recognize that the accepted standard of performance changes. To stay on the fast track of high-performance technology, they've opted for an engineering trick that harks back to the early days of desktop computing: bus-oriented designs.

Both Zenith and Wyse have turned their backs on the design trick of the IBM PC that puts the microprocessor on the motherboard—thus making it a system board. Instead they put the microprocessor, along with the rest of the essential circuitry of the machine, on one or more expansion boards.

Both you and the manufacturer benefit. When a new microprocessor or other tech-

16-MHz 386-based PCs: Summary of Features

(Products listed in ascending base price order)

BASIC CONFIGURATION	WYSEpc 386	Mitsubishi MP 386	Zenith Z-386
Price	$3,799	$4,595	$6,499
RAM	1MB	1MB	1MB
Floppy disk drives	1 1.2MB	1 1.2MB	1 1.2MB
Hard disk drives	None	None	None
Clock/calendar	●	●	●
Software	DOS 3.2	Diagnostics, setup	DOS 3.2, *Microsoft Windows/386*, setup
Monitor	○	○	○ (EGA card standard)
Ports	1 parallel, 2 serial	1 parallel, 2 serial	1 parallel, 1 serial
Slots	7 16-bit, 3 8-bit	2 32-bit, 6 16-bit, 2 8-bit	6 32-bit 2 16-bit, 2 8-bit
Power supply (watts)	220	240	200
Reset switch	○	●	○
Keyboard style	Original AT or IBM Enhanced	IBM Enhanced	IBM Enhanced
CONFIGURATION TESTED			
Price	$6,392	$6,895	$6,498
Configuration	40MB hard disk, EGA monitor	40MB hard disk, EGA monitor	80MB hard disk, flat-screen monitor
SPECIFICATIONS			
Clock speed (MHz)	8/16	12/16	8/16
Controller card handles	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives
32-bit memory expansion implementation	Intel-standard slot	Intel-standard slot	Intel-standard slot
Math coprocessor	80287 or 80387 optional	80287 or 80387 optional	80287 or 80387 optional
RAM chips	Static column	Dynamic	Static column
OTHER			
Warranty	1 year	1 year	1 year
BIOS manufacturer	Phoenix	Mitsubishi	Zenith
FCC certification class	B	B	B

PC—Indicates Editor's Choice ●—Yes ○—No

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- ★ 0 Wait State Available
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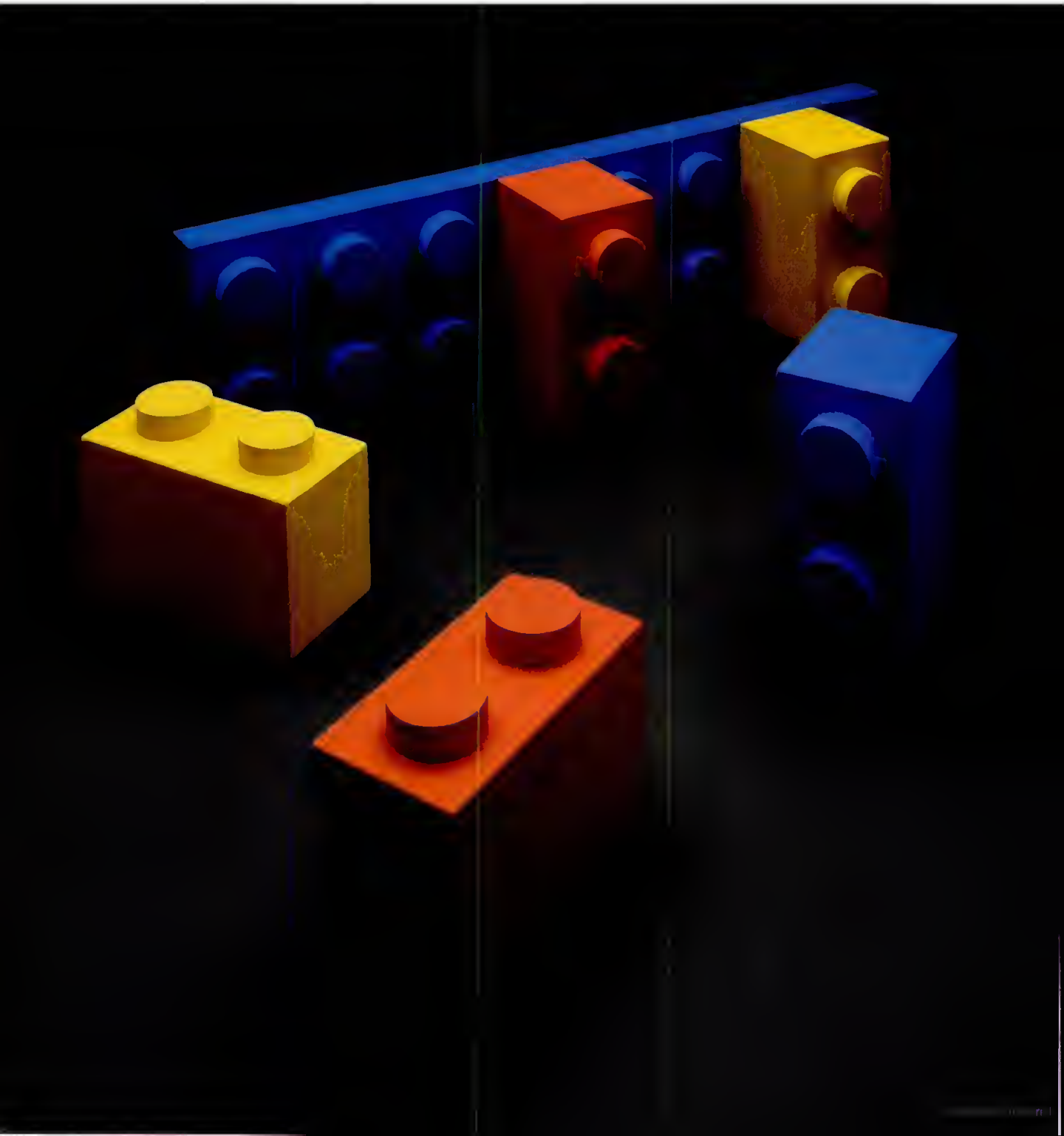

nd the PC system outgrow.

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CIRCLE 734 ON READER SERVICE CARD

nology boosts performance or requires some other alteration of computer design to keep up with the prevailing standard, the performance and personality of the bus-oriented computer can be updated merely by sliding in another CPU board or board set. The manufacturer can respond much more quickly to technological change, and you can update your equipment at much less cost just by exchanging boards—provided, of course, that the manufacturer offers the innovations that you want.

Mitsubishi, on the other hand, has taken a different design tack. That company's MP 386 incorporates a design and circuit elements that are akin to those in IBM's Personal System/2 machines to make a conventional AT-style computer based on the 80386-microprocessor. No mere knockoff, the Mitsubishi represents a fresh approach to the high-performance PC, one that combines memory caching and nibble-mode RAM to achieve the performance standard set by the Deskpro 386.

SIC TRANSIT GLORIA MUNDI How quickly the updates to the Book of Personal Computing come. Even before this trio of heavy-duty data processors became readily available, the top level of performance available from PC-standard desktop computers was pushed a little farther skyward. Compaq announced a 50-percent-faster machine based on a 20-MHz 80386 processor and a high-speed RAM cache ("The Fastest Ride Around," *PC Magazine*, January 26, 1988). Suddenly these three machines seem like also-rans in the high-performance horse race.

If your budget is unlimited, you can ignore the 16-MHz machines. The new 20-MHz Compaq Deskpro 386/20, priced at $7,499 including 1MB RAM and a 70MB hard disk, is as costly as it is fast. However, these three latest 16-MHz machines are not washed up before they begin their voyage in the marketing mainstream. Although they have to surrender their place at the top of the speed spectrum today, they are still lightning-quick.

Look back from the perspective of a year from now, and these three will represent the entry-level computers for taking advantage of the best of today's DOS technology. They deliver a defined level of performance and bring you the one feature that you will find you'll absolutely need in the next few years of your computing work—the 80386 microprocessor.

The 80386 allows you not only to keep your commitment to DOS software but also to use it to better advantage with one of the many currently available multitasking systems such as Quarterdeck's *DESQview* or *Microsoft Windows/386*. Moreover, you don't give up your ability to take advantage of OS/2 when applications that you want to run become available.

The machines also integrate into the current PC environment rather than forcing you to make a complete break. Because they are designed around the standard AT-bus, they remain compatible with the existing wealth of internal peripherals. You can switch display adapters, disk drives, internal modems, fax boards, and mice with relative impunity. This flexibility is especially important if you work in a corporate environment.

These are machines of great promises and no regrets. They deliver so much speed that you'll never bemoan having bought one. And because this trio represents some highly regarded manufacturers, you'll never have to worry about vanishing sources of support and expansion. That's a particularly important consideration with today's 80386-based computers because of the wide variation in their circuit designs.

MITSUBISHI ELECTRONICS AMERICA INC.

Mitsubishi MP 386

The $4,595 Mitsubishi MP 386 bears the cryptic legend "Assembled in USA with components from USA and Japan." Since the Oriental components include the system board, the memory board, the floppy disk drive, and the power supply, you might consider the MP 386 a Japanese head wearing an Uncle Sam hat.

Dig inside, however, and you'll find several top-of-the-line American components, too: the hard disk, the controller card, and an optional VGA-plus card. That makes the MP 386 more than a legal sidestep. It's a high-powered hybrid that combines some of the best of both sides of the world.

The large (about 12- by 15-inch) system board is built almost entirely from surface-mount components. The microprocessor is the 32-bit 80386 operating at 16 MHz and delivers performance almost exactly on a par with the 16-MHz Compaq Deskpro 386. You can also slow the system to 12 MHz by toggling a DIP (Dual In-line Package) switch.

WAIT STATES Although Mitsubishi claims zero-wait-state operation for the MP 386, that's not strictly true. To boost system throughput, the machine incorporates a 32K high-speed static memory cache that yields zero wait states when the microprocessor addresses bytes contained within the cache. Accessing bytes outside the cache may still impose wait states.

To speed the MP 386 further, you can expand the system board cache to 64K merely by plugging in nine additional memory chips.

Except for the cache, which is located on the system board, all standard system memory is included on a special proprietary expansion board that does not occupy an ordinary expansion slot. One megabyte, in the guise of 36 120-nanosecond, 256-kilobit dynamic RAM chips, is soldered to this board. This standard megabyte is split 640K to DOS, 384K extended.

To keep up with the cache, Mitsubishi uses special memory chips that operate in nibble mode; this means they can serially transfer 4 bits at a time, a big benefit in a 32-bit environment. Another 36 sockets for an additional megabyte are also available on the standard equipment memory board. These sockets must also be filled with nibble-mode DRAM chips.

You can expand the total memory of the system to 10MB by adding two 4MB memory boards ($2,195 each) into the two 32-bit expansion slots provided in the MP 386. These slots can also be used as 8- or 16-bit slots with expansion boards that do not have skirts hanging down into the connector area. The system board includes sockets for both 80287 and 80387 numeric coprocessors. According to Mitsubishi, the 80287 operates at 8 MHz, the 80387 at 16 MHz. Although you can install both coprocessors at once, you can make only one of the two chips functional at a time.

Two serial ports, a parallel port, and a floppy disk controller are all built into the

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*Monitor not included.

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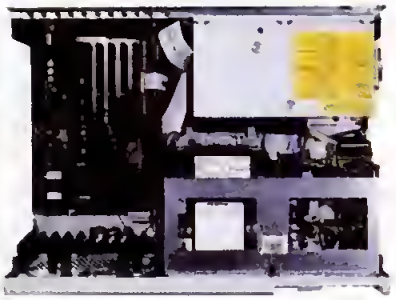

The Mitsubishi MP 386 features a fairly empty front panel with three half-height drive bays open to the front. A small plastic door (lower right, behind keyboard) opens to reveal DIP switches and a reset switch. Inside, eight expansion slots are available.

Photographs: Roberto Brosan

system board circuitry. You assign ports DOS device names or defeat them by using a bank of DIP switches accessible through a door in the front panel of the MP 386. You defeat the floppy controller by moving a system board jumper.

The port connectors are accessible at the lower center of the rear panel. The serial ports use AT-style male DB-9 connectors, while the parallel port uses a female DB-25.

BATTERY BOOST Both a clock and CMOS configuration memory form part of the system board circuitry. When the MP 386 is turned off, these features stay alive by a self-recharging nickel cadmium battery pack that's located under the speaker near the front panel. Provided you don't let too many months elapse between operating sessions (depriving the batteries of their charging time), you may never be confronted with a CMOS configuration error on the MP 386—an innovation from which other manufacturers could learn.

CMOS setup is handled by utility software that, along with diagnostics, is supplied with the system on a floppy disk.

The BIOS bears a Mitsubishi copyright and proved amenable to running whatever DOS software was tried, as well as PC-DOS 3.3. No operating system accompanies the machine, but Mitsubishi will supply MS-DOS 3.2 or Xenix System V.

A total of ten expansion slots compose the MP 386 system board: two 32-bit, six 16-bit, and two 8-bit. All will accommodate full-length, AT-height cards.

None of the slots are filled with standard equipment. Any workable configuration will require you to slide at least two cards in—a video adapter and a hard disk controller.

The evaluation machine was equipped with a Western Digital WD1003-WAH hard disk (only) controller and a Paradise Systems EGA 480 card display adapter in an 8-bit slot.

CHASSIS LAYOUT The chassis layout of the MP 386 conforms to that of the AT with space for five half-height devices. The entire right-hand stack of three half-height drive bays has front-panel access and stamped steel mounting rails.

Standard mass-storage equipment includes only a single 1.2MB, high-density

PC MAGAZINE FACT FILE

Mitsubishi MP 386
Mitsubishi Electronics America Inc.
Computer Systems Division
991 Knox St.
Torrance, CA 90502
(800) 441-2345, ext. 25
List Price: Model 110 with 1MB RAM, one 1.2MB floppy disk drive, $4,595; monochrome system, $4,895; EGA system, $5,595; Model 140 with 40MB hard disk, $5,895; monochrome system, $6,195; EGA system, $6,895; Model 170 with 70MB hard disk, $6,595; monochrome system, $6,895; EGA system, $7,595; 4MB RAM expansion card, $2,195.
In Short: A straightforward 16-MHz 386 system that performs at the level of the original Compaq Deskpro 386.
CIRCLE 668 ON READER SERVICE CARD

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CAN THIS ICEBERG SUPPLY TO L.A.?

CIRCLE 154 ON READER SERVICE CARD

Benchmark Tests: 16-MHz 80386-based PCs

All three of the machines in this review report processor speed results in the immediate vicinity of those of the 16-MHz Compaq Deskpro 386. The Zenith Z-386 turns in interesting disk access times. Its CDC 80MB hard disk has an average access time of just under 27 milliseconds, but its special "slushware" helps the performance along, boosting the average access time using DOS calls to a faster rate than that achieved directly through the hardware.

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the affect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **DOS Disk Access** benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3 and the interleave factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

Performance Times
(Times given in seconds except where noted)

	NOP	80386 Instruction Mix	Floating-Point Calculation	Conventional Memory	DOS Disk Access (milliseconds)	BIOS Disk Seek (milliseconds)	Direct to Screen	Video BIOS Routine Without Scrolling	Video BIOS Routine with Scrolling
8-MHz IBM PC AT	4.17	8.96	35.60	1.32	42.54	37.20	4.90	4.50	7.60
WYSEpc 386	2.14	3.79	14.94	0.77	41.61	27.52	7.91	8.95	12.63
Mitsubishi MP 386	2.14	4.01	15.60	0.63	29.70	26.76	8.08	5.39	9.33
IBM PS/2 Model 80	2.09	4.39	15.60	0.63	33.25	33.60	6.60	0.90	3.70
Zenith Z-386	2.09	3.79	14.23	0.57	25.52	26.45	5.27	1.48	3.74
Compaq Deskpro 386 (16-MHz)	2.09	4.01	15.50	0.77	33.32	29.20	7.90	1.50	4.80

5¼-inch floppy disk drive. Double-density 5¼-inch (360K) and single-side 3½-inch (720K) floppy drives are optional.

The evaluation system came with a Control Data Corp. 40MB, half-height hard disk—one of the made-in-U.S.A. components. The drive matched the system well, delivering an average access time of about 27 milliseconds through a standard 5-MHz ST-506 interface.

A large, 240-watt power supply occupies the right rear corner of the chassis. A slide switch on the rear panel selects 115 or 230 VAC operation. Both power input and switched power output connectors are available on the rear panel. The power switch, a black rocker, is mounted on the right side of the chassis.

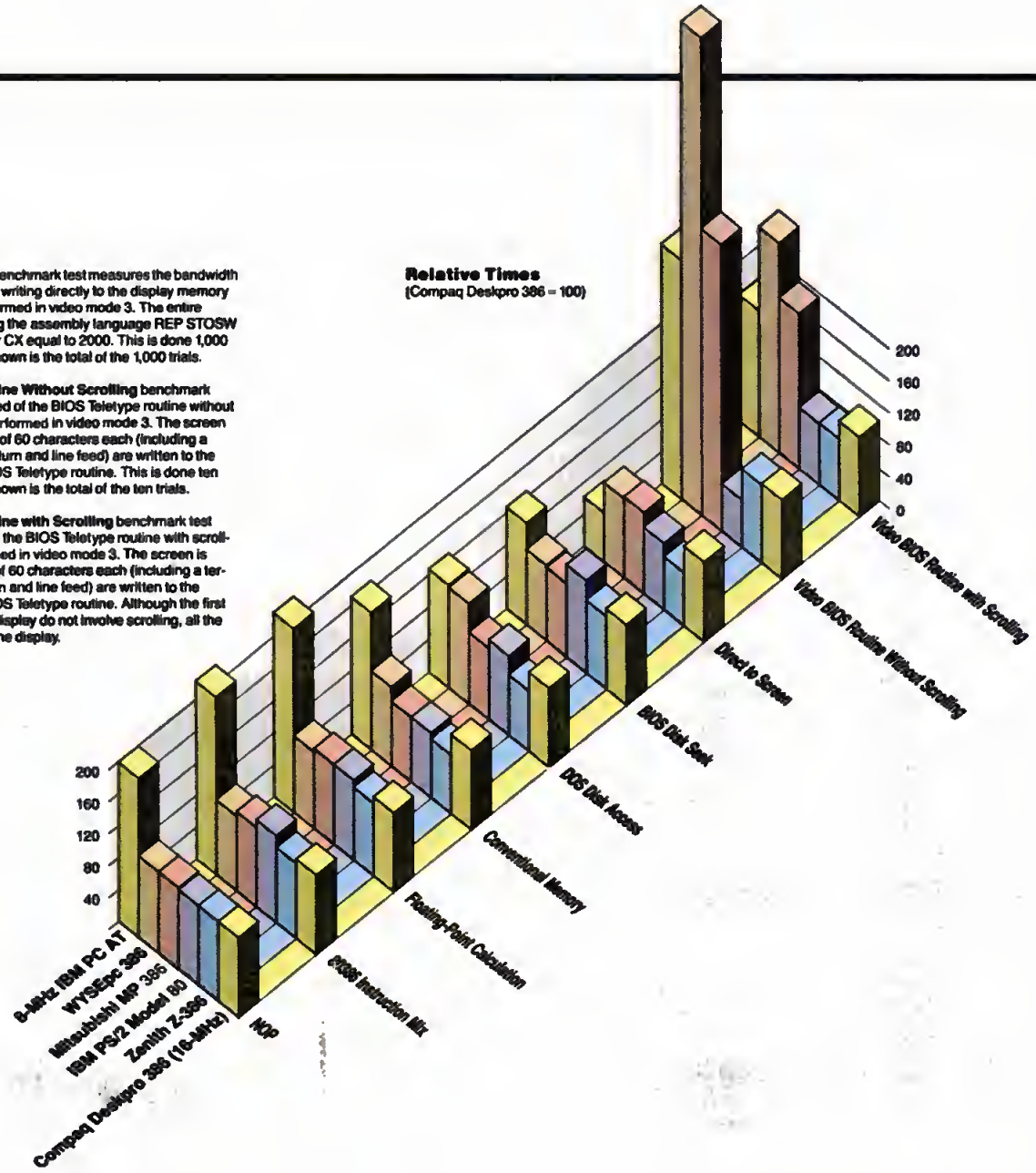
The MP 386 really rates as a wolf in cheap clothing. Its chassis is bent from flimsy sheet metal and spray-painted. It doesn't have the look or the feel of the quality computer that has to think inside the enclosure.

On the rear, the DIN-style keyboard connector is placed dead center, halfway up the chassis, so the cord can droop down and tangle with the serial and parallel cables. The front panel features DIP switches that are difficult to get at without a screwdriver. Overall, a $6,000 computer deserves to have more thought put into its packaging.

The **Direct to Screen** benchmark test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is performed in video mode 3. The entire screen is updated using the assembly language REP STOSW instruction with register CX equal to 2000. This is done 1,000 times, and the result shown is the total of the 1,000 trials.

The Video BIOS Routine Without Scrolling benchmark test measures the speed of the BIOS Teletype routine without scrolling. The test is performed in video mode 3. The screen is cleared and 24 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. This is done ten times, and the result shown is the total of the ten trials.

The Video BIOS Routine with Scrolling benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared and 240 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.



KEYBOARD PRESSURE Another problem area is the Mitsubishi keyboard, a Key Tronic model. While the layout of its 101 keys mimics the IBM Enhanced keyboard, the typing touch does not. It's quiet with a slight over-center feel, but the Spacebar requires inordinate pressure for activation—so much that spaces might inadvertently be missed between words.

The Mitsubishi EGA monitor that accompanied the evaluation unit proved to be likable and compact, capable of handling the 640 by 480 resolution of the Paradise graphics card with ease and clarity. Nevertheless, its images were no match for Zenith's flat-screen technology.

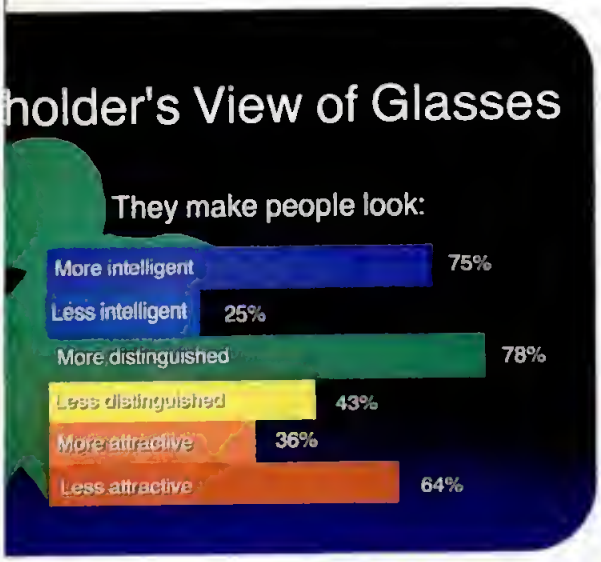
The MP 386 is both workable and likable despite its lightweight chassis and bothersome keyboard. Although such criticisms seem like nit-picking, the high prevailing standards among 80386-based PCs make even tiny flaws stand out.

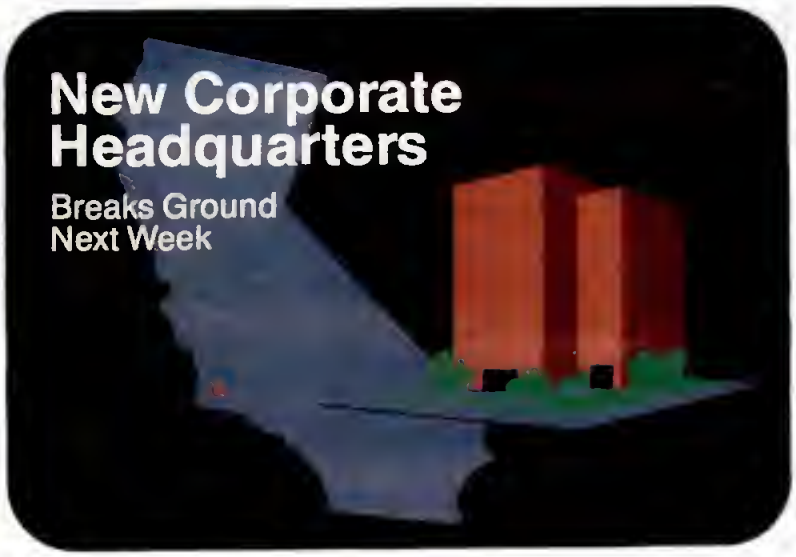
WYSE TECHNOLOGY

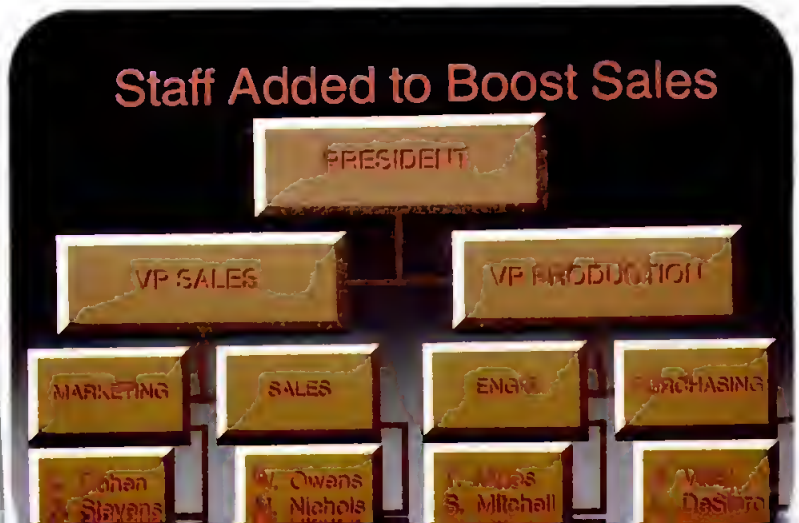
WYSEpc 386

From building terminals, Wyse Technology has attempted to move into the role of more-general supplier of office automation equipment, and if the WYSEpc 386 is any indication, offices will benefit from the invasion. The $3,799 (base system with 1MB RAM) WYSEpc 386 is designed to be an accepted desktop compan-

The state-of-the-







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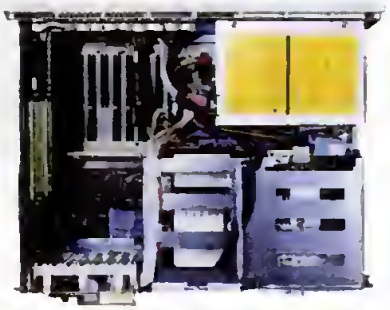

The WYSEpc 386 is one of the more distinctive machines we've seen. Four drive bays are accessible in front, and a backlit LCD readout on the left indicates current operating speed, time or date, and an undefined measurement of "microprocessor usage."

ion instead of a machine that you begrudgingly yield your desk space to, and it succeeds admirably.

Made in Taiwan, the WYSEpc 386 is a bus-oriented computer that shares a motherboard with the junior members of its product family that are based on the more modest 80286 microprocessor. As with other family members, the WYSEpc 386 boasts a Phoenix Technologies BIOS.

CIRCUITRY SANDWICH What makes the WYSEpc 386 stand out from its high-powered relatives is a stack of three circuit boards (with a smaller fourth board tucked inside the sandwich) that contain its entire 80386-based, 32-bit power and personality.

The microprocessor and a raft of discrete support circuitry are hidden as part of the filling of this sandwich, as are several configuration jumpers. The one jumper you're most likely to need to change—the one that sets the default video adapter—is readily accessible on the left side of the leftmost board.

If you want to add a numeric coprocessor, however, you'll have to dig into the sandwich both to add the chip and to set configuration jumpers, a more demanding chore than popping a chip into most machines.

Sockets are available for both 80387 and 80287 coprocessors. The former operates at full microprocessor speed while the latter can be set to run at 5, 6, or 10 MHz.

The 80386 microprocessor itself operates at either 8 or 16 MHz, selectable through software or a front-panel push button. It achieves performance that's virtually identical to that of the original Compaq Deskpro 386—roughly the equivalent of 0.8 wait state—through use of the same technology, static-column RAM.

This memory, 1MB of which is supplied as standard equipment, is contained on its own expansion board as 36 100-nanosecond, 256-kilobit socketed static-column RAM chips. Sockets for a second megabyte of these special chips are available. (Ordinary 256-kilobit chips will not work in these sockets.) You can increase the capacity of the WYSEpc 386 up to a to-

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

WYSEpc 386
Wyse Technology
3571 N. First St.
San Jose, CA 95134
(408) 433-1000
List Price: Basic system with 1MB RAM, one 1.2MB floppy disk drive, $3,799; AT-style or Enhanced-style keyboard, $145; system including 40MB hard disk, $4,999; EGA monitor, $749; EGA display adapter, $499; 1MB RAM expansion card, $250.
In Short: An elegant 386 system that is priced more at the corporate than the personal level. Quality and engineering are excellent.

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CIRCLE 127 ON READER SERVICE CARD

tal of 6MB by adding one or two additional memory boards ($250 for 1MB).

The standard megabyte of RAM is allocated with 640K assigned to DOS, 384K in the extended addressing area.

SLOT ALLOTMENT The system board itself is really a 16-bit design. Seven of its ten slots use the AT-style 16-bit bus, the other three the 8-bit XT bus. All 16-bit slots and one 8-bit are full length and AT height. The two remaining 8-bit slots are tucked behind the drive bays XT-style, offering space only for short cards 5 inches long. To achieve a full 32-bit bus structure between the microprocessor and its memory, which are on separate expansion cards, Wyse employs an auxiliary bus that connects atop the cards. In the evaluation unit this link—little more than two edge connectors tied together with a short printed circuit board—spanned the two slots occupied by the bulk of the machine's active circuitry. Substituting a wider connection assembly would allow proprietary 32-bit expansion to one or more adjacent expansion slots.

Standard equipment leaves seven slots vacant for the peripheral additions you choose to make to the machine.

One slot is saved for peripherals by putting to work the otherwise empty space in front of the narrow system board housing

the Western Digital–based combined floppy and hard disk controller, which extended forward from its own dedicated expansion connector in the plan of the WYSEpc 386's system board.

Besides the two 16-bit leftmost slots given over to the principal electronics of the system, a standard-equipment input/output board and an EGA-style display adapter take slot space as standard equipment. Although the Wyse video board was installed in one of the machine's 16-bit slots, it is a short, 8-bit board that could easily be moved next to a short slot adjacent to the I/O card (which is also in a short slot) to yield more 16-bit expansion space.

Although the specifications of the WYSEpc 386 indicate only one serial port is standard equipment, the I/O card in the evaluation unit provided two, in addition to a parallel port.

Both serial ports were equipped with AT-style male DB-9 connectors, one on the I/O card and one on a retaining bracket at the far left of the chassis, connected with a ribbon cable. The parallel port was equipped with a female DB-25 connector on the I/O card bracket.

MAIN MECHANICALS Outside of the unusual board arrangement, the main mechanicals of the WYSEpc 386 are quite conventional. The large 220-watt power

Your system should come with more than a box and a handshake. It should come with a guarantee that it will work. Unfortunately, the computer salesman was long on sales talk, but short on commitments.

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supply occupies the right rear corner of the chassis. Its rocker-style on/off switch, a slide switch for selecting 115- or 230-volt operation, power input, and monitor power connectors all appear on the rear panel.

In front are the drive bays, arranged AT-style to accommodate the equivalent of five half-height devices, four of which have front-panel access. One 1.2MB, high-density 5¼-inch floppy disk drive is standard; it sits in the top-right bay.

The rest of the bays are sealed with pale beige blank panels—but not sealed tightly enough to contain the red light coming from the constantly glowing LED's on the front panel of the evaluation unit internal hard disk. The leaking lumens were the only flaw in the otherwise attractive styling of the machine.

The optional hard disk, a CDC half-height, 40MB unit, delivered good performance with a tested average access time of about 27 milliseconds. It uses a standard ST-506 interface with a 5-MHz maximum data transfer rate.

The case is rather pretty but odd, or maybe just pretty odd. The unusual part is a backlit LCD just to the left of the drive bays, with three small push buttons underneath.

Besides indicating the operating speed of the system—its only worthwhile purpose—the little gewgaw shows the time or date (push-button selectable), or the most valueless indication of all: "microprocessor usage."

This little marvel of a bar chart is meant to show how hard your WYSEpc 386 is working. If it has any bearing on reality, the 70 percent usage it indicates when nothing but a DOS prompt graces the screen is unnerving at best.

Two of the three push buttons change the modes of this LCD. The third button toggles the operating speed of the system between 8 and 16 MHz. At the far left there is a keyboard keylock that effectively prevents the removal of the chassis cover when locked.

Wyse dresses up the rear panel of the WYSEpc 386 with a plastic fascia and even provides a cover that hides the connections to the expansion slots while letting the cables trail away underneath.

ATTRACTIVE MONITOR The attractive look of the system owes much to its EGA display. The Wyse monitor performs well, although it's hardly in the class of the flat-screen Zenith. But Wyse is one of the few companies that seem able to pare down the chassis of an EGA display to hardly larger than a monochrome monitor's box.

The Wyse monitor incorporates a few other useful features. For instance, a small

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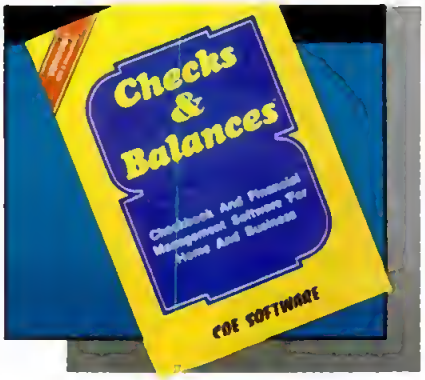

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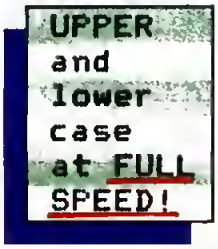

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spring-loaded retaining wire prevents you from accidentally pulling the modular power cord out of the monitor. (It also prompts the question, why not install such a retainer on the computer itself?) A three-position slide switch under the bottom-right corner of the screen changes between color and two text-oriented monochrome modes, green and amber. A combined brightness/contrast thumbwheel hides farther back on this edge. Altogether, the Wyse proved a pleasant EGA display to work with.

The Wyse keyboard features the 101-key IBM Enhanced keyboard layout (except for inexplicably shrunken Alt keys) and strange squarish styling. Its gray color is not a good match for the system unit, and its quiet touch rates as indifferent—not up to the IBM standard but nothing that will shred your fingers and patience. It uses telephone-style cable and connectors, and it plugs into a modular jack on the retaining bracket of the CPU card.

As with all AT-style 80386 computers, the WYSEpc 386 includes a built-in clock and CMOS configuration memory, kept alive by a Tadiran lithium battery hidden near the speaker behind the front panel. Diagnostics are combined into the setup program supplied with the MS-DOS 3.2 that accompanies the system.

Except for the extremely confusing discussion of memory expansion, the scant documentation is clearly written and will be sufficient to aid new users in getting the system up and running. It lacks depth, however, and includes virtually no technical information.

Appearance is not the only feature of the WYSEpc 386 that makes it a wonderful office mate. It also rates, subjectively at least, as the quietest 80386-based PC of all 25 that PC Labs has tested thus far. Typical office din will smother the sound of its power supply fan. Even the hard and floppy disk drives are as quiet as well-behaved Victorian children.

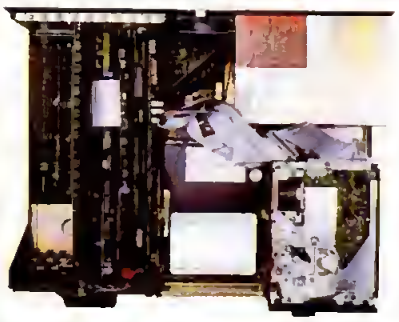
The peace it brings to your office may be enough to recommend the WYSEpc 386. At $4,999 with a 40MB hard disk, the system isn't cheap, but it will save you the price of a digital desktop clock. It's a great machine because it's unobtrusive but fast, and it accomplishes any job you give it with great dispatch.

ZENITH DATA SYSTEMS

Zenith Z-386

What some people call a bus, Zenith calls a backplane, but the concept is the same. Instead of putting the microprocessor and all of its support circuitry on a system board, in its $6,499 (with 40MB hard disk), American-made Z-386, Zenith locates all of the important stuff on expansion boards. This leaves a simple motherboard to do little more than connect it all together.

Zenith cites all sorts of advantages to its backplane technology, among them ease of service, expandability, and upgradability. Of course, you can't really put a mon-



It's the flat-screen monitor that sets the Zenith Z-386 apart from the competition. The $999 dazzler presents images of outstanding clarity. The system unit itself is more conventional, with four drive bays open to the front, disk activity indicators, and a lock.

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RAM TRICKS The standard equipment trick Zenith uses is page-mode RAM—which delivers the same performance advantage as the static-column memory of the Deskpro 386, allowing the system to make repeated accesses to the same memory page with zero wait states. By adding an optional memory cache board, you gain 64K of high-speed buffer that eliminates all but the last remnants of wait states.

To further improve system performance, the Z-386 employs "Slushware," a term either thought up by an intoxicated marketing denizen or meant to describe him. Zenith uses the word to describe the copying of BIOS firmware from slow BIOS chips to fast 32-bit RAM, a proven performance-enhancement technique that quickens the pace of screen updates and other system functions. In fact, the Z-386 can update a screen through DOS in about one-third the time required by the Mitsubishi or Wyse, an improvement that makes the Z-386 *seem* to run faster.

Slushware does have its drawbacks, however. In the Z-386 the toll it exacts is paid in memory. Although the standard memory of the Z-386 totals 1MB imple-

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PC MAGAZINE FACT FILE

Zenith Z-386
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List Price: Model 40 with 40MB hard disk, $6,499; Model 80 with 80MB hard disk, $7,499; monochrome monitor, $299; EGA monitor, $799; VGA-compatible flat tension mask monitor, $999; 64K cache card, $599; 1MB RAM expansion card, $699; 4MB RAM expansion card, $1,209.
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mented in 36 100-nanosecond, 256-kilobit page-mode chips, only the 640K consigned to DOS is actually available. The rest is phantom memory for use by the slushed firmware.

Three expansion cards are essential in putting a computer on the backplane. One, the CPU card, holds the 80386 microprocessor and some of its support circuitry. A memory card is required to give the chip thinking space. And an I/O (input/output) card provides not only a serial and parallel port, but also additional microprocessor support circuitry.

Both the CPU card and I/O card are about an inch longer than standard AT board length. Two special, longer slots are reserved in the Z-386 to accommodate them.

The optional memory cache requires a fourth board, connected to the CPU by both the 32-bit backplane bus and an extra ribbon cable. In addition, to make a working computer, you'll end up stuffing the Z-386 with two more boards—a combined Data Technology Corp. hard-and-floppy-disk controller and a display adapter.

BOARD ROOM A complete Z-386 thus comprises six or seven boards out of its normal endowment of ten expansion slots. With the cache controller installed, you have an XT-style 8-bit slot, an AT-style 16-bit, and a proprietary Zenith 32-bit expansion slot left free. Forgo the cache card, and you've got one more 32-bit slot free. In either case, you get substantially fewer slots than you do with most other 80386-based PCs.

Some Z-386 board design elements deserve comment. Nearly all the integrated circuits used—the number is large because nearly the entire machine is built from discrete chips—are socketed. Zenith has gone to great lengths to keep down radio frequency interference inside the Z-386, even adding ferrite chokes on most connecting wires as well as on every bus lead of the CPU card.

Several jumpers and two DIP switch banks are mounted on the CPU card, which fits in its special slot next to the I/O card. Making any adjustments to these controls will require pulling the CPU board from the machine. Because of the ribbon cable that runs to the cache board, you may have to remove that card, too. Although you probably won't have to make any adjustments to the Z-386 when it's delivered, the machine doesn't rate high for user convenience.

The backplane of the Z-386 holds the keyboard connector, which appears in the conventional AT position near the center of the chassis's rear, and a battery holder for a special lithium cell that keeps the con-

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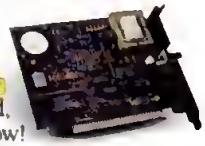

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figuration memory and clock running when the system is switched off.

The Z-386 power supply is rated at 200 watts and is mounted in the usual right-rear chassis corner. On the rear panel are a power input jack, a small rocker-style power switch, and a recessed 115/230-volt selector slide switch. The fan blows out the right side of the chassis.

A second fan mounted in the rear panel is ducted to cool the circuitry of the Z-386. Two fans don't necessarily mean twice the noise, but in the Z-386 they seem to.

The serial port uses a male DB-9 connector, the parallel port a female DB-25. Both are located on the I/O-card retaining bracket.

MASS-STORAGE OPTIONS For mass storage, the Z-386 chassis provides an unusual arrangement of drive bays. On the front panel you'll see openings for four half-height bays, each separated from the others both horizontally and vertically by a width of plastic front panel. Behind the fascia, the mounting scheme is more conventional—the drive directly screwed into the sides of the bay—and allows you to slide full-height hard disks behind a vertical pair of the separated half-height faceplates.

Standard hardware includes one 1.2MB high-density 5¼-inch floppy disk drive. Hard disk options include 40 and 80MB (unformatted) drives.

The Z-386 Model 80 that was received for review came with a high-speed Control Data Corp. 80MB drive that yielded 72MB of formatted capacity with an average access time just under 28 milliseconds. Slushware apparently helps the performance of this drive along, boosting the average access time using DOS function calls to a faster rate than that attainable directly through hardware.

One feature that helps the Z-386 to stand out among the crush of 80386-based PCs is its *Monitor*, a firmware program that constitutes part of its Zenith-copyrighted BIOS ROM.

Monitor combines the function of a setup program and DOS's DEBUG. You access the command-driven program by pressing the Ctrl-Alt-Ins key combination and are greeted after a few seconds by an arrowlike prompt. The program then accepts single-letter commands much like those of DEBUG and gives much the same results. For instance, T (for Trace) executes one machine-language instruction and displays the status of all microprocessor registers. You can also display color bars to use *Monitor* to help you adjust your monitor.

To enter the setup portion of *Monitor* and configure the battery-supported CMOS RAM of the Z-386, you simply type Setup at the arrow prompt. Besides setting the time and date of the built-in clock, you can alter the display-mode, floppy-, and hard-drive parameters and select the boot device. The Z-386 will boot PC-style (trying the floppy first, then the hard disk), from hard disk only, or from floppy disk.

The Z-386 includes its own proprietary display adapter that emulates all popular video standards including MDA, CGA, Hercules, and EGA. A VGA-compatible adapter is also available. The Zenith adapter handles emulation, allowing one monitor to show any video standard. The adapter provides both 9-pin digital and 15-pin PS/2-style analog outputs.

The Zenith 101-key keyboard loosely follows the IBM Enhanced design with just enough changes to keep you cursing, should you frequently move from one to the other. Most bothersome is the mysterious moving Backslash key. The keyboard otherwise rates as mediocre, with no audible feedback and little feel.

STELLAR MONITOR The evaluation Z-386 came with an optional Zenith flat-screen monitor, the analog input VGA-compatible (and everything else) monitor that was a recent winner of *PC Magazine*'s Award for Technical Excellence. The flat screen is indeed an awesome improvement over conventional technology, geometrically perfect—although some people report seeing a slight concavity to its image. It's bright, sharp, and colorful, and it provides great contrast—in every way a desirable on-screen display, perhaps the best that's available today.

Were only the rest of the monitor as appealing as its on-screen image. The box itself is big, bulky (particularly when compared with that of the Wyse), and styled so that it looks bent toward the front. Worse, all the circuitry that Zenith has stuffed inside evidently runs so hot that Zenith has crammed a fan inside, adding more to the cacophony of your office.

The Z-386 is a powerful, pleasing computer but lacks enough expansion space and makes a lot of noise. Its features seem aimed more at the hobbyist user (for instance, built-in DEBUG) rather than the office worker. Nevertheless, it has all the power you need to crunch through any processing problem that you give it at 80386 speed.

Winn L. Rosch is a contributing editor of PC Magazine.

PC MAGAZINE EDITOR'S CHOICE

• **WYSEpc 386**

You wouldn't be tempted to shove any one of this threesome off your desk. Although the ruckus made by the Zenith would tempt one to such ends, its fast screen updates and disk access more than suppress the urge. Despite a flimsy case and bothersome keyboard, the hybrid Japanese-American Mitsubishi will get the job done with aplomb.

The best overall choice among these three is the peaceful, unassuming WYSEpc 386, not for the digital clock but for its excellent design and adept harnessing of 80386 power.

And the Wyse model is an able competitor among our previous Editor's Choices in the 386 category: the Compaq Deskpro 386, the IBM PS/2 Model 80, the PC's Limited 386-16, and the NCR PC916. The Model 80 remains the technology leader and the Compaq Deskpro 386/20 remains the speed leader, but in this group only the PC's Limited machine costs less than the Wyse model. At $6,392 for a 40MB system with EGA monitor, the WYSEpc 386 is a good buy at the high end of the 386 market.

"Simple To Use, Works Well And Best Of All Is Easy On The Budget"

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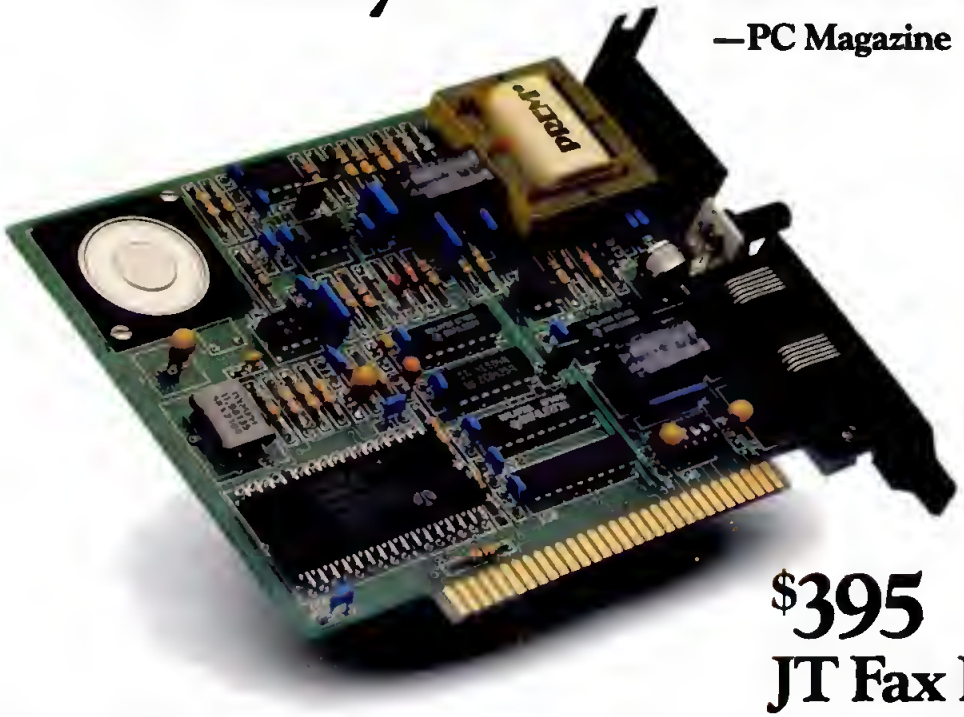

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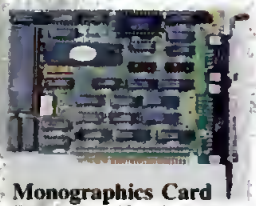

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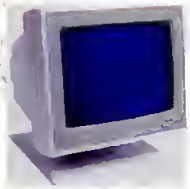

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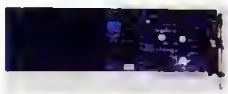

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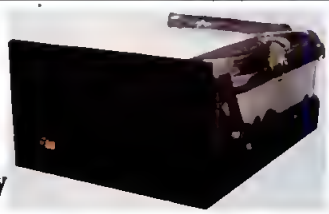

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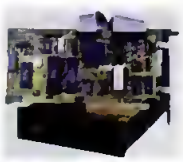

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**InfoWorld,* December 1987.

Hardware Specifications: Requires PC/MS-DOS version 2.0 or higher with 384K of usable memory and a minimum 10 MB hard disk. For use with the IBM® PC, PC XT, PC AT, Personal System/2™ and compatibles. 3½" media optionally available. Not copy protected.

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Whatever your keyboard, TOGGLE.COM will tell you the true state of your CapsLock, NumLock, and ScrollLock keys and let you change them to stay in step with your LED display.

Some of the best utilities are short programs that simply do their thing and depart. Not every utility need be an operating system adjunct like PRINT .COM or a full-blown application like *SideKick* or *SuperKey*. Often, what you need is simply something to fix a frustrating bug in the DOS user interface.

That's what TOGGLE.COM does. It's a compact program that reports—and lets you change—the state of your computer's CapsLock, NumLock, and ScrollLock keys, either from the DOS command line or from within a batch file. At least three groups of readers should be interested in TOGGLE.

If you have one of the "old-style" PC and XT 83-key keyboards, which don't have any status lights to indicate the state of the toggle keys, TOGGLE will keep you from having to start typing mistakes to find out.

Or if you own one of the many IBM-compatible keyboards whose status lights don't always keep in sync with their respective function states, TOGGLE lets you query your system for a listing of the current CapsLock, NumLock, and ScrollLock status.

And even True Bluers with up-to-date Enhanced (101-key) keyboards will find TOGGLE useful. The BIOS that interfaces these keyboards with the CPU boots with the NumLock state active—just opposite to the default off state characteristic of all earlier keyboards. A simple one-line insertion made to your AUTOEXEC.BAT file will bring up your system with NumLock off, or with any of the three states set to the condition that you specify.

Both the assembly language source code (TOGGLE.ASM) and the alternative TOGGLE.BAS, a BASIC program that will automatically create TOGGLE.COM without requiring a macro assembler, are printed in this article. To avoid the keyboarding chore, however, it's easier to download either these files or an already-assembled, ready-to-run copy of TOGGLE.COM from the PC Magazine Interactive Reader Service. Follow the instructions given in the sidebar "TOGGLE by Modem."

PRODUCTIVITY INDEX

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USING TOGGLE TOGGLE can handle any desired on/off combination of the CapsLock, NumLock, and ScrollLock keys. Its syntax is

```
TOGGLE [+c|-c] [+n|-n] [+s|-s]
```

where the c parameter stands for CapsLock, n for NumLock, and s for ScrollLock. Preceding any of the identifying parameters with a plus symbol toggles the state on, while preceding it with a minus switches it off. The single-character parameters may be entered in any order, and in either upper- or lowercase.

Any number of the command line switches can be combined on a single command line, up to the 128-character limit imposed on a command line by DOS. To turn NumLock off, for example, and leave CapsLock and ScrollLock unchanged, you'd enter

```
TOGGLE -n
```

Or to flip CapsLock on, NumLock on, and ScrollLock off, you'd run TOGGLE with the following command line:

```
TOGGLE +c +n -s
```

Each time you run it, TOGGLE responds by listing the on/off condition of each of the three states. Since any parameters are

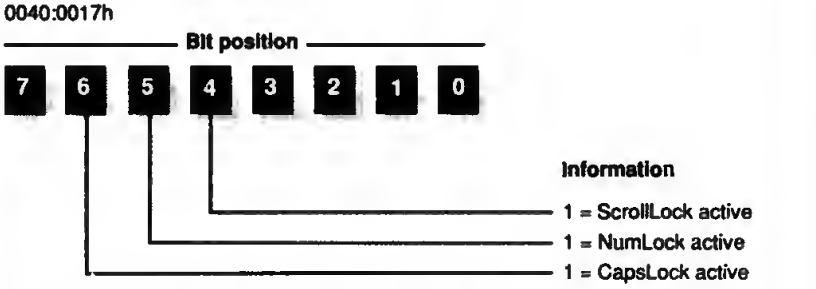
processed before the states are echoed to the screen, the listing shown always reflects the state of the machine *after* the program has done its work. In the example just cited, TOGGLE will display the following message:

```
CapsLock   :  On
NumLock    :  On
ScrollLock :  Off
```

You can check the current settings without altering them at any time simply by running TOGGLE without including any command line parameters.

If TOGGLE detects a syntax error while parsing the command line, it will stop scanning the entries and display a line denoting its correct usage. Any valid en-

BIOS Data Area Keyboard State Byte



The three bits in the primary keyboard byte that correspond to CapsLock, NumLock, and ScrollLock.

```
;=============================================================================
; TOGGLE.COM for the IBM Personal Computer - 1988 by Jeff Prosise
;
; TOGGLE allows the CapsLock, NumLock, and ScrollLock states to be
; toggled on and off in batch mode.  Syntax is:
;
;       TOGGLE [+c|-c] [+n|-n] [+s|-s]
;
; where the 'c' parameter controls the CapsLock state, 'n' controls
; NumLock, and 's' controls ScrollLock.
;=============================================================================

BIOS_DATA       SEGMENT AT 40H
                ORG     17H
SHIFT_STATE     DB      ?                       ;bit 4 = ScrollLock
                                                ;bit 5 = NumLock
                                                ;bit 6 = CapsLock
BIOS_DATA       ENDS

;=============================================================================
; Code Segment (code and data)
;=============================================================================
CODE            SEGMENT PARA PUBLIC 'CODE'
                ASSUME  CS:CODE, DS:CODE
                ORG     100H
BEGIN:          JMP     MAIN

CR              EQU     13
LF              EQU     10

PROGRAM         DB      "TOGGLE 1.0 (c) 1988 Biff Communications Co.",CR,LF
                DB      "PC MAgazine ",254," Jeff Prosise",CR,LF,"$",1AH

ERRMSG          DB      CR,LF,"Usage:  TOGGLE [+c|-c] [+n|-n] [+s|-s]"
                DB      CR,LF,"$"

TEXT1           DB      CR,LF
                DB      "    CapsLock   : $"
TEXT2           DB      "    NumLock    : $"
TEXT3           DB      "    ScrollLock : $"
ONTEST          DB      "On",CR,LF,"$"
OFFTEST         DB      "Off",CR,LF,"$"

;-----------------------------------------------------------------------------
; MAIN is the primary portion of the code.
;-----------------------------------------------------------------------------
MAIN            PROC    NEAR

                MOV     AX,BIOS_DATA            ;point ES to BIOS Data Area
                MOV     ES,AX
                ASSUME  ES:BIOS_DATA
                CLD                             ;clear DF
                MOV     SI,81H                  ;point SI to command line
;
;Search the command line for entries, and loop until all are processed.
;
MAINLOOP:       LODSB                           ;search for next non-space
                CMP     AL,20H
                JE      MAINLOOP

                CMP     AL,0DH                  ;branch if end-of-line reached
                JE      END_PARSE
                CMP     AL,"+"                  ;branch if plus operator is
                JE      PROCESS                 ;  encountered
                CMP     AL,"-"                  ;branch if minus operator is
                JZ      PROCESS                 ;  encountered
;
;An unrecognized entry was found.  Print correct syntax and exit.
;
ERROR_EXIT:     MOV     AH,9                    ;display correct syntax
                MOV     DX,OFFSET ERRMSG
                INT     21H
                MOV     AX,4C01H                ;exit with ERRORLEVEL = 1
                INT     21H
;
;Check current parameter against list of valid ones.
;
PROCESS:        LODSB                           ;get parameter byte
                AND     AL,0DFH                 ;capitalize it
                MOV     AH,1BH                  ;branch if parameter is an "S"
                CMP     AL,"S"
                JE      TOGGLE_STATE_BIT
                MOV     AH,20H                  ;branch on "N"
                CMP     AL,"N"
                JE      TOGGLE_STATE_BIT
                MOV     AH,40H                  ;branch on "C"
                CMP     AL,"C"
                JNE     ERROR_EXIT
;
;Turn the indicated state bit on or off.
;
TOGGLE_STATE_BIT:
                CMP     BYTE PTR [SI-2],"+"     ;branch if operator was a
                JNE     CLEAR_BIT               ;  minus symbol
                OR      [SHIFT_STATE],AH        ;turn indicated state on
                JMP     MAINLOOP                ;reenter parsing loop

CLEAR_BIT:      MOV     AH                      ;complement bit indicator
                AND     [SHIFT_STATE],AH        ;turn indicated state off
                JMP     MAINLOOP                ;reenter parsing loop
;
;Display current status of all three lock states and exit.
;
END_PARSE:      MOV     AH,9                    ;display copyright notice
                MOV     DX,OFFSET  PROGRAM
                INT     21H

                MOV     AH,9                    ;display CapsLock state
                MOV     DX,OFFSET TEXT1
                INT     21H
                MOV     AH,40H
                CALL    PRINT_STATE

                MOV     AH,9                    ;display NumLock state
                MOV     DX,OFFSET TEXT2
                INT     21H
                MOV     AH,20H
                CALL    PRINT_STATE

                MOV     AH,9                    ;display ScrollLock state
                MOV     DX,OFFSET TEXT3
                INT     21H
                MOV     AH,10H
                CALL    PRINT_STATE

                MOV     AH,4CH                  ;exit with ERRORLEVEL = 0
                INT     21H
MAIN            ENDP

;-----------------------------------------------------------------------------
; PRINT_STATE is called by MAIN to display "On" or "Off" to a 1 or 0 value,
; respectively, of the bit in the BIOS shift state byte indicated in AH.
;-----------------------------------------------------------------------------
PRINT_STATE     PROC    NEAR
                MOV     DX,OFFSET OFFTEST       ;preload "Off" text address
                TEST    [SHIFT_STATE],AH        ;test actual state
                JZ      IS_OFF                  ;branch if assumption valid
                MOV     DX,OFFSET ONTEXT        ;load "On" text address
IS_OFF:         MOV     AH,9                    ;display "On" or "Off"

                INT     21H
                RET
PRINT_STATE     ENDP

CODE            ENDS
                END BEGIN
```

TOGGLE.ASM: *The assembly language source code for TOGGLE.COM.*

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S I G M A D E S I G N S

tries encountered before the erroneous data in the left-to-right scan will be executed first. One convenient way to take advantage of this error detection feature is to type in the command

```
TOGGLE /h
```

(where h stands for "help") if you forget TOGGLE's correct syntax. Since it doesn't explicitly recognize the /h parameter (or a ? parameter, which would trigger the same response) it will harmlessly come back with the message

```
Usage: TOGGLE [+c|-c] [+n|-n] [+s|-s]
```

reminding you how to use it.

KEYBOARD STATES The BIOS stores a record of the CapsLock, NumLock, and ScrollLock states in bits 4 through 6 of the primary keyboard byte, at address 0040:0017 inside the BIOS Data Area. The diagram "BIOS Data Area Keyboard State Byte" displays these bit assignments. Turning a state on is as simple as setting the corresponding bit to 1, and toggling it back off requires only that the bit be reset to 0. The keyboard BIOS checks these bits to determine how a keystroke should be interpreted each time it processes a keystroke. If the scan code 72 is received, for instance, the BIOS looks at the NumLock bit (bit 5) before deciding whether to put the ASCII code for an Up Arrow or for the number 8 in the keyboard buffer.

TOGGLE decodes what you type on the command line and translates each parameter into a bit value that corresponds to the appropriate BIOS Data Area bit. The BIOS byte is ORed with the bit value if the parameter was preceded by a plus (thus turning the bit on), and ANDed with the complement if you entered a minus (thus turning the bit off while leaving all others unchanged).

Not all keyboards are created equal, however. The keyboards for IBM's original PC and XT machines contained no LEDs (light-emitting diodes) to show the CapsLock, NumLock, and ScrollLock states. Without TOGGLE, finding out if CapsLock was active requires pressing a character key to see if the letter comes out in upper- or lowercase.

The PC AT keyboard introduced a feature that subsequently became standard on all IBM keyboards and on most of those for "compatibles." A trio of LEDs in the upper right-hand corner of the keyboard shows, in real time, which (if any) of the three toggles is active. Pressing CapsLock lights the CapsLock LED, making it visually clear that CapsLock is active. IBM systems from the PC AT onward have included logic in the BIOS to ensure that these lights were toggled on and off when appropriate, not only when a key was physically actuated, but also when a program altered one of the associated state bits (see the sidebar "Keyboard LED Synchronization" for further explanation).

The PC AT LEDs were such an attractive and inexpensive feature that most companies that make keyboards for "compatible" machines have included them even on keyboards intended for XT-class machines. The standard XT BIOS, however, has no provisions for keeping the indicator lights in sync with the BIOS state bits. The result is that if you own an IBM-compatible machine with a keyboard that's more advanced than its BIOS, running certain programs (including a utility like TOGGLE) will alter the CapsLock, NumLock, and ScrollLock states but may not update the LEDs correspondingly. The so-

KEYBOARD LED SYNCHRONIZATION

The sophistication of today's keyboards has made it impossible simply to pick any keyboard on the basis of its "feel" or layout and plug it into the computer of your choice. The on-board keyboard controller (housed inside the box, alongside the CPU) and system BIOS must be specifically configured to match the features of the keyboard itself. If you're using an IBM clone with keyboard indicator lights and TOGGLE doesn't set or reset the LEDs as it toggles CapsLock, NumLock, or ScrollLock on or off, then you've run up against a mismatched keyboard and BIOS.

All IBM machines equipped with 84- and 101-key keyboards feature logic in the keyboard BIOS to toggle the appropriate keyboard LED as well as the corresponding bit of the primary keyboard byte when a press of CapsLock, NumLock, or ScrollLock is detected. Each time an indicator light is toggled, the BIOS records its new state in one of the three bits 0–2 of the byte at 0040:0097.

These LED status bits are compared with the status bits of the primary keyboard byte each time function 1 of interrupt 16h is invoked and each time function 0 loops while it awaits the appearance of a keycode in the keyboard buffer. (Function 1 of the keyboard I/O interrupt is used to check keyboard buffer status, and function 0 is called to read a keystroke.) If the two sets of bits are not in agreement, the BIOS momentarily pauses and calls upon an internal subroutine to update the indicator lights. Thus, the keyboard LEDs remain synchronized with the BIOS state bits, even if a party other than the BIOS alters one of those bits.

Many compatible manufacturers, on the other hand, pair a clone of the original PC BIOS with an LED keyboard. Since IBM's early machines were designed to interface to an 83-key keyboard with no LED indicators, their respective BIOSs contained none of the support outlined above. And without that support, there's no link between BIOS RAM and the LEDs. These keyboards contain logic in their own hardware to toggle status lights on and off each time a key is physically activated but cannot know when a state bit has been altered by a program instead. TOGGLE can let you resynchronize the LEDs with the real keyboard state, and the synchronization will last for this type of BIOS until something other than a keypress changes the CapsLock, NumLock, or ScrollLock conditions.

—Jeff Prosise

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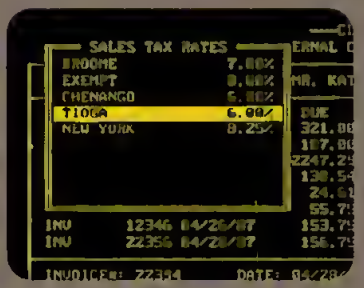

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CIRCLE 271 ON READER SERVICE CARD

TOGGLE BY MODEM

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If you use the Xmodem protocol, you can download TOGGLE.COM directly, saving typing or downloading either the .BAS or the .ASM version. TOGGLE.BAS, whether entered from the magazine at your keyboard or downloaded from PC-IRS, will automatically create TOGGLE.COM when run once in BASIC. TOGGLE.ASM, also listed both here and on PC-IRS, allows you to modify the program, but requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM TOGGLE;
LINK TOGGLE;
EXE2BIN TOGGLE TOGGLE.COM
```

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.

TOGGLE Command

Jeff Prosise — 1988 No. 10 (Utilities)

Purpose: Provides a software toggle and an on-screen report of the states of the CapsLock, NumLock, and ScrollLock keys.

Format: `TOGGLE [+c|-c] [+n|-n] [+s|-s]`

Remarks: Entered without any parameters, TOGGLE simply reports the current status of the three toggle keys. The c (CapsLock), n (NumLock), and s (ScrollLock) parameters may be added on the TOGGLE command line to change the state of the specified key(s). A + (plus sign) preceding a parameter toggles that key on; a - (minus sign) forces that key off. The optional parameters may be entered singly or in any combination and order, and in upper- or lowercase. Requested parameter changes are processed before TOGGLE issues its on-screen report. Entering TOGGLE with any unrecognized parameter (/H or ?, for example) produces an error message that displays the correct syntax.

With 83-key PC and XT keyboards, which lack status LEDs, TOGGLE eliminates the need to determine the states of the CapsLock, NumLock, and ScrollLock keys by trial and error.

Owners of "compatible" 84-key keyboards often find that their status LEDs get out of sync with the true states of the toggle keys. This condition arises when an LED-equipped keyboard is matched with an XT BIOS design, which lacks provisions for updating the indicators when a program rather than a keystroke changes the toggle-key state. TOGGLE can be used to restore the synchronization, which will be retained as long as only keystrokes are used to change the toggle keys' status.

The BIOS interface for the current 101-key (Enhanced) keyboard causes the machine to boot up with the NumLock state on. All previous keyboards have provided the opposite default condition. Including the line

```
TOGGLE -n
```

in the AUTOEXEC.BAT file will cause the NumLock key to boot up in the off state when using the Enhanced keyboard.

■ UTILITIES

```
100 REM — BASIC PROGRAM TO CREATE toggle.COM
110 OPEN "toggle.COM" AS #1 LEN = 1
120 FIELD #1,1 AS A$
130 CHECKSUM = 0
140 FOR I = 1 TO  43
150     LINESUM = 0
155     PRINT ".";
160     FOR J = 1 TO 9
170         READ BYTE
180         CHECKSUM = CHECKSUM + BYTE
190         LINESUM = LINESUM + BYTE
200         IF (BYTE < 256) THEN LSET A$ = CHR$(BYTE)
210         PUT #1
220     NEXT J
230     READ LINECHECK
240     IF LINECHECK <> LINESUM THEN PRINT "Error in Line";200 + 10 * I
250 NEXT I
260 CLOSE
270 IF CHECKSUM = 26871 THEN PRINT "Successful Completion!" : END
280 PRINT "COM file is not valid!" : END
290 DATA     233,    100,      0,     84,     75,     71,     71,     74,    802
300 DATA      69,     32,     45,     66,     68,     32,     48,     59,    415
310 DATA      61,     32,     45,     57,     56,     54,     32,     58,    613
320 DATA     105,    102,    102,     32,     67,    111,    109,    105,    737
330 DATA     117,    116,    105,     99,     97,    116,    105,    111,    848
340 DATA     110,    115,     32,     67,    111,     64,     13,     10,    506
350 DATA      80,     67,     32,     77,     57,    103,     57,    122,    675
360 DATA     105,    110,    101,     32,    256,     32,     74,    101,    885
370 DATA     102,    102,     32,     80,    116,    111,    115,    105,    741
380 DATA     115,    101,     13,     10,     34,     26,     13,     10,    326
390 DATA      85,    115,     97,    103,    101,     58,     32,     32,    623
400 DATA      86,     79,     71,     71,     76,     69,     32,     91,    573
410 DATA      63,     99,    124,     65,     95,     92,     32,     51,    426
420 DATA      63,    110,    126,     65,    110,     93,     22,     91,    640
430 DATA      43,    115,    124,     45,    115,     93,     13,     10,    550
440 DATA      34,     13,     10,     32,     32,     32,     32,     47,    254
450 DATA      97,    112,    115,     76,    111,     59,    107,     32,    745
460 DATA      32,     32,     58,     32,     32,     36,     32,     32,    286
470 DATA      32,     32,     78,    117,    105,     74,    111,     99,    656
480 DATA     107,     32,     32,     32,     32,     58,     32,     32,    357
490 DATA      36,     32,     32,     32,     32,     83,     55,    114,    460
500 DATA     111,    100,    100,     74,    111,     99,    107,     32,    752
510 DATA      58,     32,     32,     36,     79,    110,     13,     10,    370
520 DATA      36,     79,    102,    102,     13,     10,     36,    106,    562
530 DATA      44,      0,    162,    152,    252,    150,    125,      0,    965
540 DATA     172,     48,     32,    114,    251,     68,     13,    114,    820
550 DATA      43,     48,     43,    114,     14,     48,     45,    114,    515
560 DATA      12,    100,      5,    106,     78,      1,    205,     33,    784
570 DATA     106,      1,     74,    205,     33,    172,     36,    223,    538
580 DATA     100,     14,     68,     83,    116,     12,    100,     32,    679
590 DATA      68,     78,    116,      6,    100,     64,     68,     67,    631
600 DATA     117,    223,    120,    126,    256,     63,    117,      7,   1013
610 DATA      38,      0,     38,     23,      0,    235,    193,    266,    781
620 DATA     212,     38,     32,     38,     33,      0,    235,    106,    762
630 DATA     100,      9,    106,      3,      1,    205,     33,    100,    757
640 DATA       5,    104,    121,      1,    205,     33,    100,     66,    799
650 DATA     232,     25,      0,    100,      5,    104,    142,      1,    779
660 DATA     205,     33,    100,     32,    232,     17,      0,    100,    875
670 DATA       9,    106,    161,      1,    205,     33,    100,     16,    791
680 DATA     232,      5,      0,    104,      0,     76,    205,     33,    735
690 DATA     106,    105,      1,     38,    132,     30,     23,      0,    603
700 DATA     114,      3,    106,    100,      1,    100,      9,    205,    800
710 DATA      33,    155,      0,      0,      0,      0,      0,      0,    328
```

TOGGLE.BAS: *A BASIC program that will automatically create TOGGLE.COM.*

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■ **UTILITIES**

lution is to use TOGGLE to change the out-of-sync condition, then to hit the affected key to return to the previous state, this time with the LEDs in sync.

TOGGLE does not directly manipulate the keyboard LEDs; the BIOS shoulders that burden itself. IBM's 84- and 101-key keyboards (as well as the 102-key models available in other countries) allow programs to set and reset individual status lights with a simple command to the keyboard controller. The procedure is to OUT the command byte EDh to port address 60h, wait for the keyboard to acknowledge by returning FAh, then send a byte whose lower three bits reflect the desired LED states. Bit 0 corresponds to ScrollLock, bit 1 to NumLock, and bit 2 to CapsLock. A bit set to 1 will light an indicator, while a 0 bit will turn it off. Since there's no way to address the command to a single LED, the BIOS maintains a record of the status of all three LEDs at 0040:0097. The same byte is used by the BIOS in the comparison to the primary keyboard byte to determine whether the indicators and the actual states are out of phase so that they need to be adjusted.

■ If you're a beginning assembly language programmer, TOGGLE's source code provides an entry point into this programming domain that won't overwhelm you.

A CLOSING NOTE Writing a utility like TOGGLE is more an exercise in optimizing code than a programming challenge. Yet compact utilities like this one often prove to be the most useful, especially when they can help you tailor a system to meet your own configuration needs.

If you're a beginning assembly language programmer, TOGGLE's source code provides an entry point into this programming domain that won't overwhelm you. It shows how an iterative parsing routine can scan the command line, acting sequentially on each entry it finds until the end of the line is encountered, and how a single AND instruction can capitalize an ASCII character. Such tricks and techniques are the meat and potatoes of assembly language programming and useful additions to every programmer's toolbox. PC

Jeff Prosise is a contributing editor of PC Magazine.

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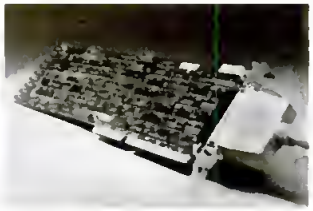

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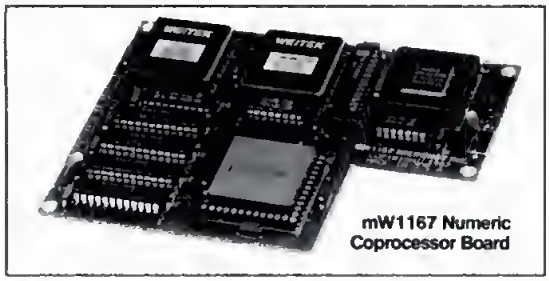

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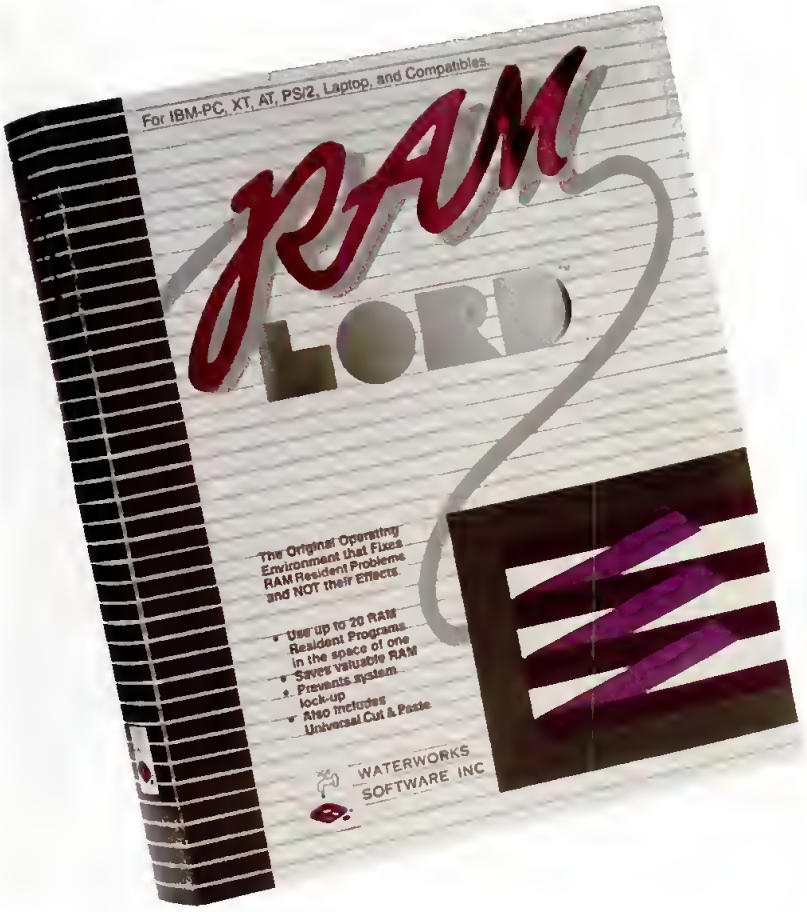

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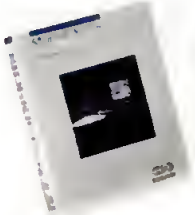

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■ ENVIRONMENTS ■ CHARLES PETZOLD

OPENING A FILE IN OS/2

The demands of multitasking make opening files with OS/2's DosOpen function call a far more complicated task than it was using the old DOS interrupt 21h.

The DUMP.ASM program presented in last issue's Environments column uses the OS/2 DosOpen function to open a file. One of the most complex of the OS/2 kernel function calls, DosOpen requires no fewer than 13 assembly language PUSH instructions to store eight parameters (or their addresses) on the stack.

When I first began programming for OS/2, it took me about 15 minutes to set up the correct parameters for a DosOpen call. Now, after much experience, it still takes me 10. When I complained about this to one of the OS/2 developers, he replied, "DosOpen is not a nightmare at all. DosOpen is *versatile*." Well, that it is.

It's time to face this complex function bravely and answer the question: Why is it more difficult to open a file under OS/2 than under DOS?

SHARING RESOURCES OS/2 is a multitasking operating system. Usually when we think about multitasking, we think about how the operating system rapidly switches control between two or more programs so that they appear to be running simultaneously. But multitasking requires much more than simply switching control between programs. When two or more programs run concurrently, the operating system must also ensure that the programs share resources appropriately.

These resources include disk files. The operating system must protect an open file that is being used by one application from being altered or destroyed by another application. On the other hand, the operating system must also allow files to be shared by two or more applications if the applications are ready and willing to share the files.

In short, the DosOpen call is as complex as it is because OS/2 must accommodate the contradictory requirements of file protection and file sharing. Through the DosOpen call, an application must inform the operating system how it intends to use a particular file. Only then does OS/2 know to what extent it should protect the file from other applications.

EIGHT DOSOPEN PARAMETERS The OS/2 DosOpen function replaces the DOS interrupt 21h function calls 3Dh (Open a File) and 3Ch (Create a File). The eight parameters of the DosOpen function are shown in the table "DosOpen Parameters." The first three parameters are far addresses (pointers, in C lingo) that require both a segment and offset. The last parameter must be set to 0 in OS/2, version 1.0.

As with all OS/2 kernel function calls, DosOpen returns a 0 if the function succeeds and a nonzero error code if the function fails. In assembly language programs, the value returned is stored in register AX. If DosOpen returns 0, the file is open and the file pointer is set to the first byte of the file.

The first DosOpen parameter is a character string with the filename and an optional disk drive and directory. The second parameter is a far pointer to a 16-bit integer variable. If DosOpen succeeds in opening the file, OS/2 uses this variable to store the file handle. The file handle is a number used to refer to the file in subsequent function calls such as DosRead, DosWrite, and DosClose, just as in DOS 2.0 and above.

If you're creating a new file, you also

DosOpen Parameters

Parameter	In/out	C data type	ASM data type
Filename	In	char *	Address of BYTE string
File Handle	Out	unsigned int *	Address of WORD
Action Taken	Out	unsigned int *	Address of WORD
File Size	In	unsigned long	DWORD
File Attribute	In	unsigned int	WORD
Open Flag	In	unsigned int	WORD
Open Mode	In	unsigned int	WORD
Reserved	——	unsigned long	DWORD

The eight parameters of the OS/2 DosOpen function.

supply an initial File Size and File Attributes. The file attribute bits are the same as those used in DOS 2.0 and above: they specify whether the file is read-only, hidden, system, or archived.

OPEN FLAG AND ACTION TAKEN When you use DosOpen to open an existing file or create a new file, you use the Open Flag parameter to specify what you want OS/2 to do if the file exists or does not exist. This is shown in the diagram "Open Flag for DosOpen Function."

For example, if you use an Open Flag parameter of 01h, OS/2 will open the file only if it already exists. If the file does not exist, the DosOpen function will fail by returning an error code of 110 (which is named ERROR_OPEN_FAILED). The DUMP.ASM program in last issue's Environments column uses an Open Flag parameter of 01h—obviously DUMP shouldn't create a new file if it can't find the file specified on its command line.

DosOpen Action Taken Values

Action Taken value	Meaning
1	File existed and was opened
2	File did not exist but was created
3	File existed and was truncated

Values of Action Taken variable returned by the DosOpen call.

Many applications today ask for confirmation before they write over an existing file. To implement a check like this in a program, you can attempt to open the file using an Open Flag of 10h. This causes OS/2 to create the file but to fail the DosOpen function if the file already exists. If DosOpen returns the ERROR_OPEN_FAILED code, the program then asks the user if it's OK to write over the file. With the user's approval, the program then calls DosOpen again with an Open Flag of 02h.

If the DosOpen function succeeds in opening a file, it saves a value in the 16-bit variable called Action Taken. The address of this variable is the third parameter of the DosOpen function. If DosOpen succeeds, this variable will have one of three values shown in the table "DosOpen Action Taken Values." Note how these values correspond to the options in the Open Flag parameter. You need look at the value of Action Taken only when you use an Open Flag of 11h or 12h. The Action Taken flag tells you whether the file already existed or was created.

An example: recently I've been writing a small OS/2 modem communications program. When you want to download to a file, the program asks for a filename and then opens the file with an Open Flag of 11h. This value tells OS/2 to open the file if it exists and to create the file if it doesn't exist. If DosOpen returns 0, the program then looks at the value of Action Taken. This can be either 1 (if the file existed already) or 2 (if it was created). If the value of Action Taken is 1, then the program asks the user whether the file should be replaced or appended to, or whether the downloading should be canceled.

If the user responds by saying the file should be replaced, the program then uses the DosNewSize function to set the size of the file to 0, essentially wiping out what was there before. If the user says the file should be appended to, then the program sets the file pointer to the end of the file using the DosChgFilePtr function. If the user wants the downloading to be canceled, the program simply closes the file.

OPEN MODE PARAMETER Open Mode is the most complex DosOpen parameter. This is a 16-bit value whose bits are encoded as shown in the diagram "Open Mode for DosOpen Function."

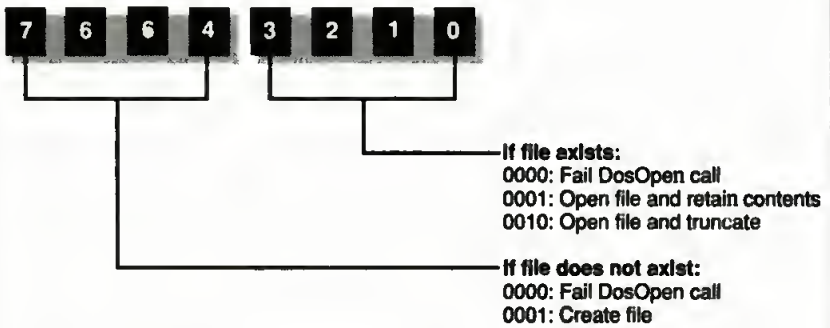
The least-significant 8 bits in the Open Mode value are the same as those used in register AL of DOS function call 3Dh (beginning with DOS 3.0). These specify how the file will be accessed by the application and how it should be shared with other applications. The only difference in OS/2 is that the "compatibility" sharing mode is not supported.

A program uses the Access Mode bits to specify how it intends to use the file, whether for reading or writing or both. (An Access Mode of "read only" means that the program will read the file but not write to it. This has nothing to do with the "read only" file attribute.) A program uses the Sharing Mode to restrict access to the open file by other programs.

When a program attempts to open a file that is already open, OS/2 uses logic involving the Access Mode and Sharing Mode specified in the first and in the second DosOpen functions to determine whether the two programs can use the same file.

This can be most easily understood by means of an example. Suppose that Program 1 opens a file with an Access Mode of "read only" and a Sharing Mode of "deny write." In this case the program is telling OS/2 that it needs only to read the

Open Flag for DosOpen Function



The meaning of Open Flag parameter bits in the DosOpen function.

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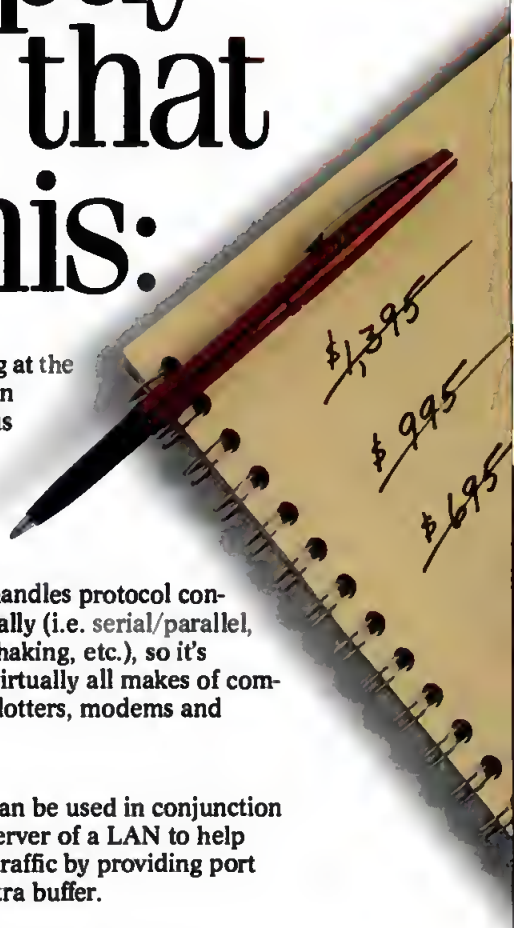

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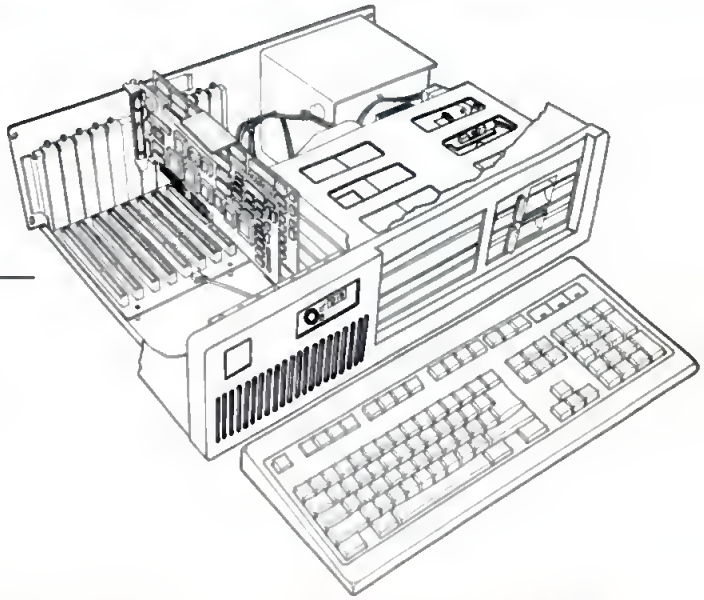

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■ ENVIRONMENTS

file and that no other program should be allowed to write to the file while Program 1 has the file open.

If Program 2 then tries to open the same file with an Access Mode of "write only" or "read and write," the DosOpen call will fail. That's because Program 1 is prohibiting other programs from writing to that file. If Program 2 tries to open the file with an Access Mode of "read only" but a Sharing Mode of "deny read" or "deny read or write," the DosOpen call will also fail because Program 1 is (already) reading the file and Program 2 is trying to prohibit other programs from reading the file. Program 2 can open the same file only with an Access Mode of "read only" and a Sharing Mode of "deny write" or "deny neither read nor write."

The DUMP program shown in last issue's Environments column specified an Access Mode of "read only" and a Sharing Mode of "deny write." This is normal for a program that only looks at files and does not alter them. There is no reason to restrict other programs from reading the same file. Indeed, in a multitasking environment, DUMP is more useful if it can be used at the same time as another program (such as a text BROWSE program) that displays the contents of the same file.

A database management program that works over a network may be designed so that multiple copies of the program can read and write to the same file. Such a program would open files with an Access Mode of "read and write" but a Sharing Mode of "deny neither read nor write."

■ Anyone who has some experience with DOS interrupt 24h will admit that the OS/2 approach is much more rational.

This allows other programs to open the same file with the same Access Mode and Sharing Mode. The program then uses DosFileLocks to restrict access to sections of the file when it is being updated.

CRITICAL ERROR HANDLING Two other bits in the Open Mode value are rather interesting in the way that they replace entire interrupts in DOS. The first of these is the Critical Error Handling bit.

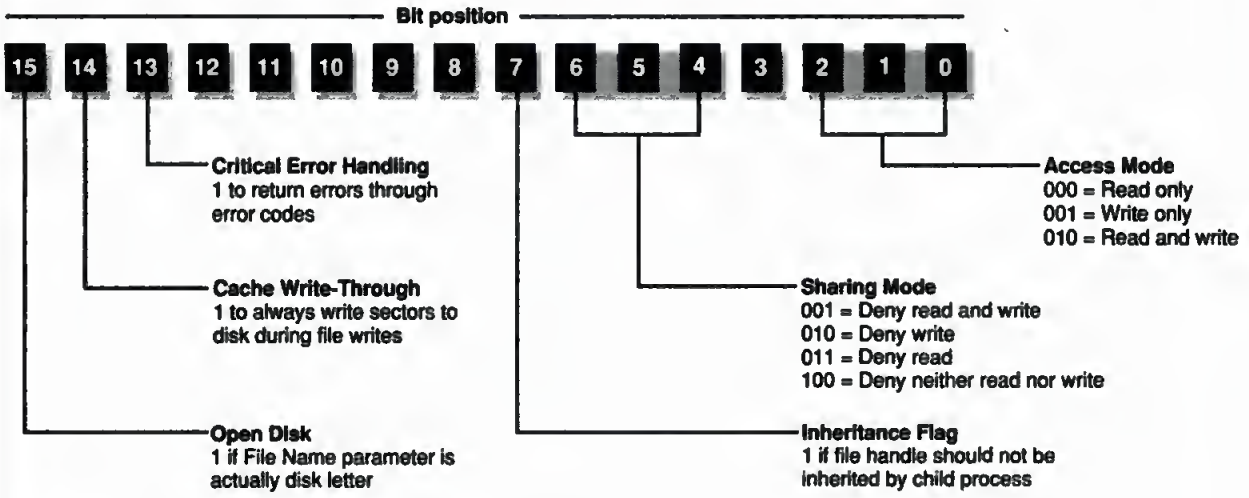
When a critical error occurs under OS/2 (for example, when a program tries to read an unformatted diskette or a section of a disk with a bad sector), OS/2 normally displays a pop-up screen with the options "End the program," "Return the error to the program," or "Retry the operation."

A program might instead want to take responsibility for reporting critical errors to the user. If so, it sets the Critical Error Handling bit in the Open Mode parameter of DosOpen to 1. Then if any critical errors occur during the DosOpen function or during any accesses of the open file, OS/2 reports the error to the program through the return code of DosOpen rather than by presenting the pop-up screen. This is most useful in programs that are meant to be run detached (that is, run in the background).

Under DOS, a program that wishes to handle critical errors itself must trap interrupt 24h. Anyone who has some experience with DOS interrupt 24h will admit that the OS/2 approach is much easier and much more rational.

READING DISK SECTORS The Critical Error Handling bit in the DosOpen Open Mode parameter replaces one DOS interrupt; the Open Disk bit replaces two

Open Mode for DosOpen Function



The meaning of Open Mode parameter bits in the DosOpen function.

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more DOS interrupts—interrupt 25h (Disk Read) and interrupt 26h (Disk Write). These DOS interrupts let you read and write disk sectors.

If the Open Disk bit is set to 1, then OS/2 interprets the File Name parameter as a disk drive letter. (The drive letter must be followed by a colon.) The file handle returned from the DosOpen function can then be used to read and write to the disk using DosRead and DosWrite. You treat the disk as if it were a very large file.

There are some restrictions on writing to disks that have been opened in this way—the disk can be written to only if no open files are on the disk, for example. Obviously, by writing directly to the disk you could make an open file disappear, and this is not allowed. Any currently running OS/2 program is an open file because OS/2 must be able to reload code segments from the program's .EXE file into memory. An OS/2 boot disk always contains open files because certain files must always be available for reloading by the operating system. If you boot OS/2 from a floppy disk but direct it to use dynamic link libraries (such as KBDCALLS.DLL) located on your hard disk, then these dynamic link libraries are also open files.

This means that it's very difficult to write directly to a hard disk if you boot OS/2 from the hard disk. I'm interested to see how the OS/2 versions of *The Norton Utilities*, *Mace Utilities*, and similar packages will handle this problem. But it's more important to know that the problem also affects OS/2 external commands that write directly to a disk, such as CHKDSK. Under OS/2 you can't use CHKDSK with the /F switch on the disk from which you've booted OS/2. You have to boot OS/2 entirely from a floppy diskette to use the /F switch on your hard disk. Moreover, CHKDSK itself must be on the diskette, because if it's loaded from the hard disk, then CHKDSK.EXE itself becomes an open file until the program terminates.

■ The disk can be written to only if no open files are on it. Writing directly to the disk could make an open file disappear, and this is not allowed.

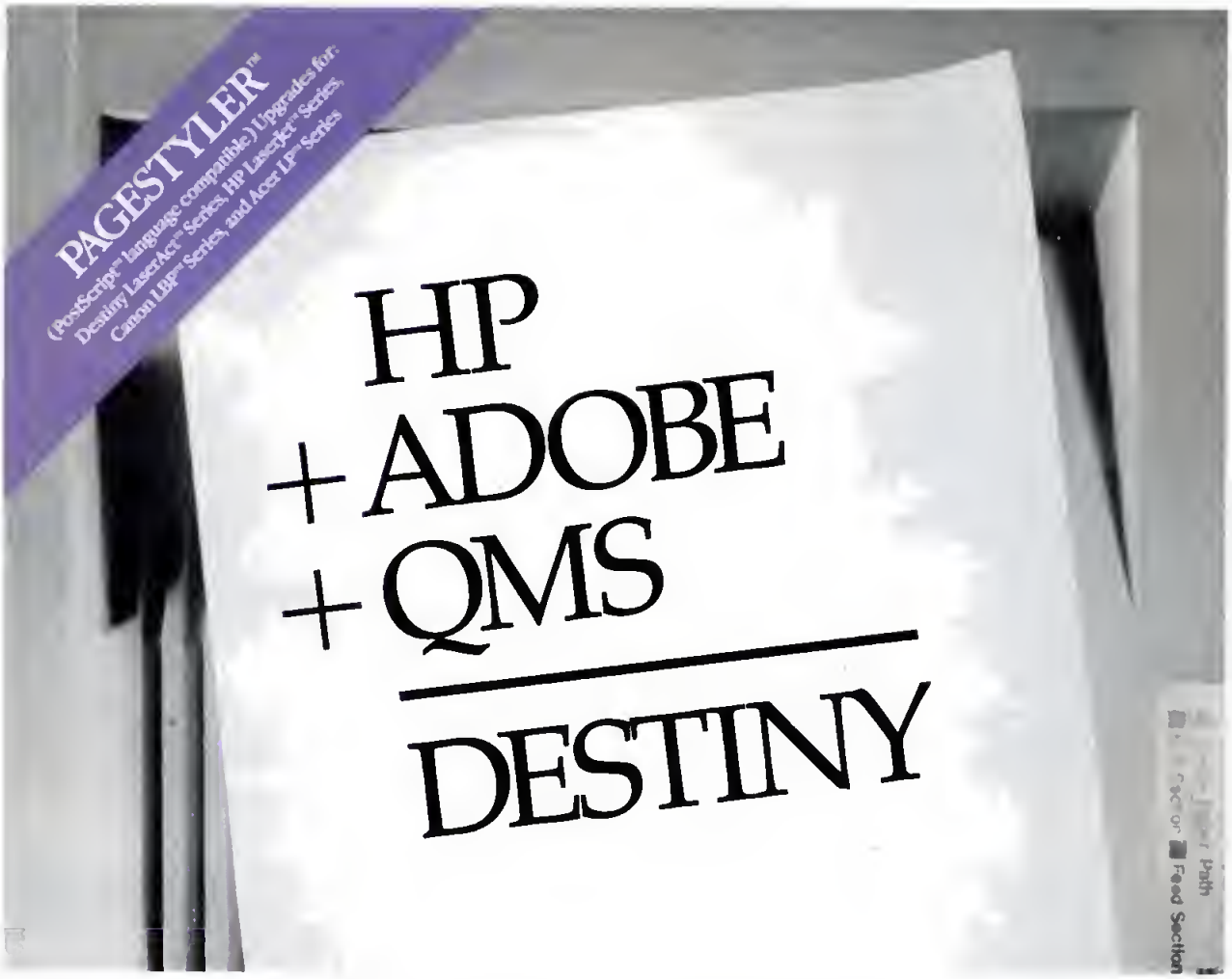
OS/2 has some IOCTL calls to assist in directly accessing disks. These report the physical layout of the disk (heads, cylinders, and sectors per track) and logical layout of the disk (size of FAT, number of root directory entries, sectors per cluster, and so forth) and also allow "locking" and "unlocking" a disk to prevent the disk from being used by other programs while it is being written to. This is certainly not as easy as using interrupt 26h to write to a disk, but it is necessary in a multitasking environment.

SMART APPS, STUPID APPS Even though the DosOpen call is complex, there is nothing superfluous in it. I think it's clear that when a program opens a file, it must tell OS/2 the extent to which the file should be protected from access by other programs. This is the only way OS/2 can adequately protect the open file but still leave available the option of sharing files among applications.

Existing DOS applications—except those that have been written for DOS 3.*x* using the extended form of the DOS function call 3Dh to open a file—do not provide OS/2 with the information it needs to correctly protect the file. This is one reason why you can't wrap a multitasking operating system around existing DOS applications. If you want a multitasking operating system, you also need new applications that are aware of the environment.

But wait a minute. Aren't there a whole bunch of environments available now that multitask existing DOS programs?

Well, sure, and you'll certainly find people—even some who otherwise seem fairly intelligent—who say that these environments provide an alternative to a real operating system such as OS/2. Many of these environments (such as *DESQview*, *Windows/386*, PC-MOS/386, and Concurrent DOS 386) exploit the virtual-86 mode of the 80386 microprocessor to multitask existing DOS programs, which is



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■ ENVIRONMENTS

something that OS/2 doesn't even attempt.

But running existing DOS programs under any of these environments is unsatisfactory. For example, the operating system has only two options for handling the conflict when two programs try to open the same files. For one, it could ignore the problem and allow the two programs to write to the same file at the same time. Surely that is not desirable. The alternative is to prohibit two programs from even reading the same file at the same time. This is overkill and is also undesirable.

When OS/2 runs DOS 2.*x* programs under the DOS compatibility mode, it uses the second approach. When a file is opened by a DOS 2.*x* program, OS/2 prohibits all other programs from accessing that same file even if both programs need only to read from the file.

Under OS/2 I can run 12 copies of DUMP in 12 different sessions, all dumping the same file at the same time. But while any of these programs are running I cannot run a DOS version of DUMP to look at the same file. OS/2 won't let me because it assumes the DOS program needs exclusive use of the file. Likewise, if I run the DOS version of DUMP first and suspend it halfway through the dump, I cannot use the OS/2 version of DUMP to look at the same file.

■ Operating systems exist solely to be used and exploited by applications.

To my mind, applications should be smarter than the operating system under which they run. The operating system exists solely to be used and exploited by applications. If the operating system is more sophisticated than an application, then the application fails to be as good as is potentially possible.

Under DOS, it's easy for an application to be smarter than the operating system. But run that DOS application under *Windows/386* or *DESQview* or OS/2's DOS Compatibility Mode and the application turns stupid. The application thinks it's still running under DOS, but it's not. The application cannot take advantage of any facilities that the new environment has to offer, and it acts in ways that are not appropriate for the environment.

I want a smart operating system *and* smart applications. We won't get one without the other.

PC MAGAZINE

"The (Chicony) keyboard achieves a touch that is the closest to the official IBM feel..."
PC Magazine (Sep. 29, 1987)

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PC Magazine (Feb. 16, 1988)

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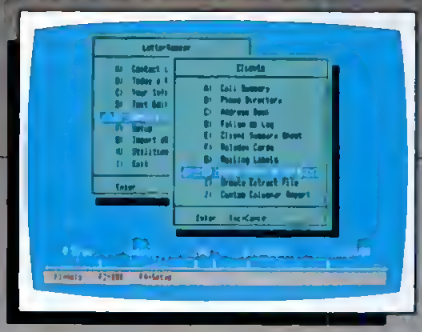
4:30 **"Susan—Send our sales letter to all buyers of apples and cherries in Washington and oranges or bananas in Florida, in time for today's 5:00pm pick-up.—Mr. Wermer."**

4:32 **Mailing lists sorted.**

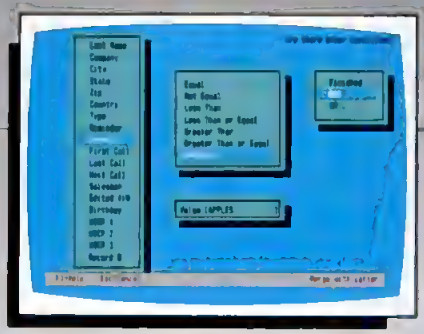


Our new LetterMaster mailing software is a lifesaver. It sorts any list according to any criteria in its own internal database and our dBASE® III files.

4:33 **Lists merged and purged.**

LetterMaster merges lists and purges duplications in a matter of seconds. It's incredible! I can create instant custom mailing lists with a few keystrokes!

4:38 **Personalized sales letters printed.**

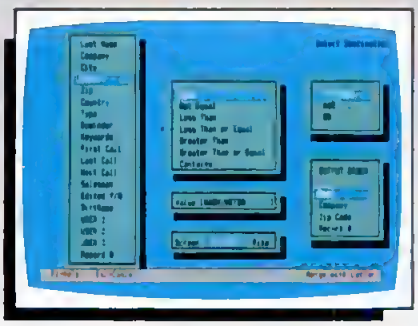


With LetterMaster, all I do is name the list, name the letter, activate the printer, and "go do." It's that simple!

4:41 **Labels printed.**

LetterMaster prints off any list onto leading brand address labels. It prints Rolodex cards and file folder labels, too.

4:45 **Mailing complete and ready for pick-up.**



LetterMaster operates with all the popular word processing programs. About the only thing it doesn't do is lick the envelopes!

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5:00 **"Susan—Good work on that mailing.**

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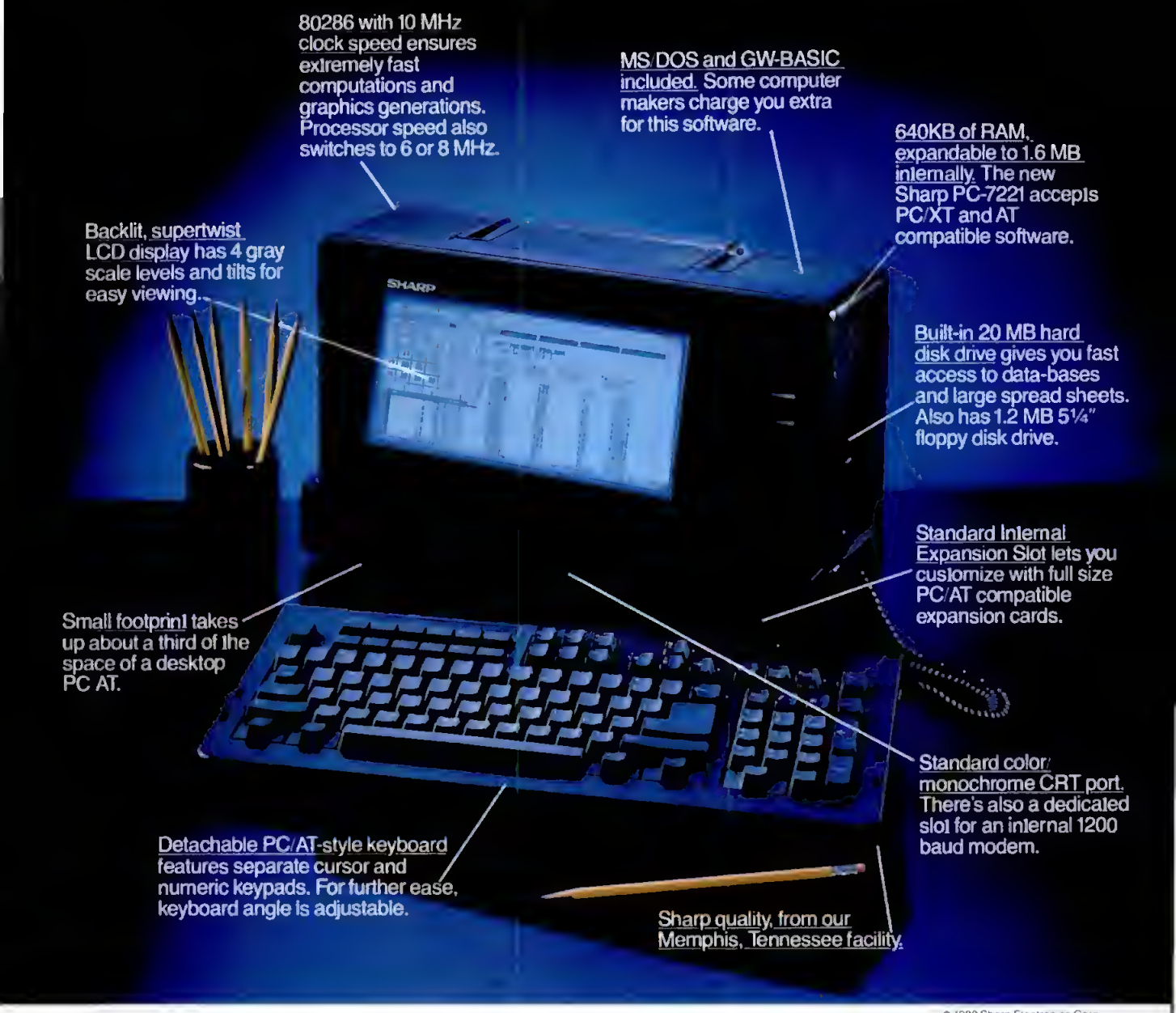

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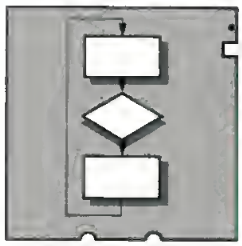
■ POWER PROGRAMMING ■ RAY DUNCAN

MASM TIME AND DATE FORMATTING ROUTINES



This issue presents the assembly language equivalents of the C routines discussed in the last issue. These routines convert binary times and dates to ASCII strings.

Last time, I discussed how MS-DOS represents times and dates and the internationalizing support functions it provides programs for customizing their output for use in different countries. I also presented a set of C routines that convert binary times and dates to ASCII strings. In this column, I'll present assembly language equivalents of the same conversion routines, which you can add to your Power Programming library of MASM building blocks.

MS-DOS TIMES AND DATES First, let's briefly review the time and date formats used by MS-DOS and returned to application programs as a result of various interrupt 21h function calls.

The system, or "4-byte," formats for time and date are used by the MS-DOS function calls that deal with the system's real-time clock driver directly. These MS-DOS function calls are

Int. 21h Func.	Purpose
2Ah	Get system date
2Bh	Set system date
2Ch	Get system time
2Dh	Set system time

The 4-byte formats are shown in the diagram "Four-Byte Format Storage." They are easy to work with because each element of the time or date is stored in one or two complete bytes, with no need for shifts or masking of bits.

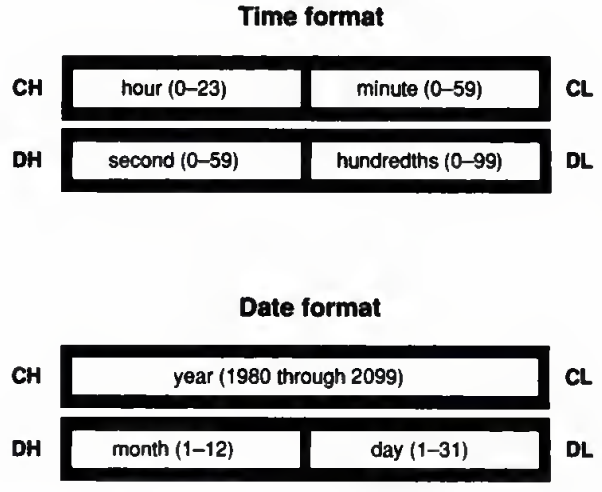
The directory, or "2-byte," formats for date and time are provided to application programs in connection with certain file management functions, which include the following:

Int. 21h Func.	Purpose
0Fh	Open file with FCB
11h	Search for first file
12h	Search for next file
16h	Create file with FCB
4Eh	Search for first file
4Fh	Search for next file
57h	Get/Set file date/time

As shown in the diagram "Two-Byte Format Storage," the 2-byte formats pack the time and date into bit fields. The bit fields must be shifted and masked with AND operations to get at the information. As compared with the 4-byte formats for time and date, the 2-byte formats sacrifice some information content: seconds are stored only in units of two, and the hundredths of seconds are not stored at all.

The MS-DOS service Get or Set Current Country (interrupt 21h function 38h) allows programs running under MS-DOS,

Four-Byte Format Storage



Four-byte time and date formats used by INT 21h functions 2Ah through 2Dh. These system services accept arguments or return results in registers CX and DX.

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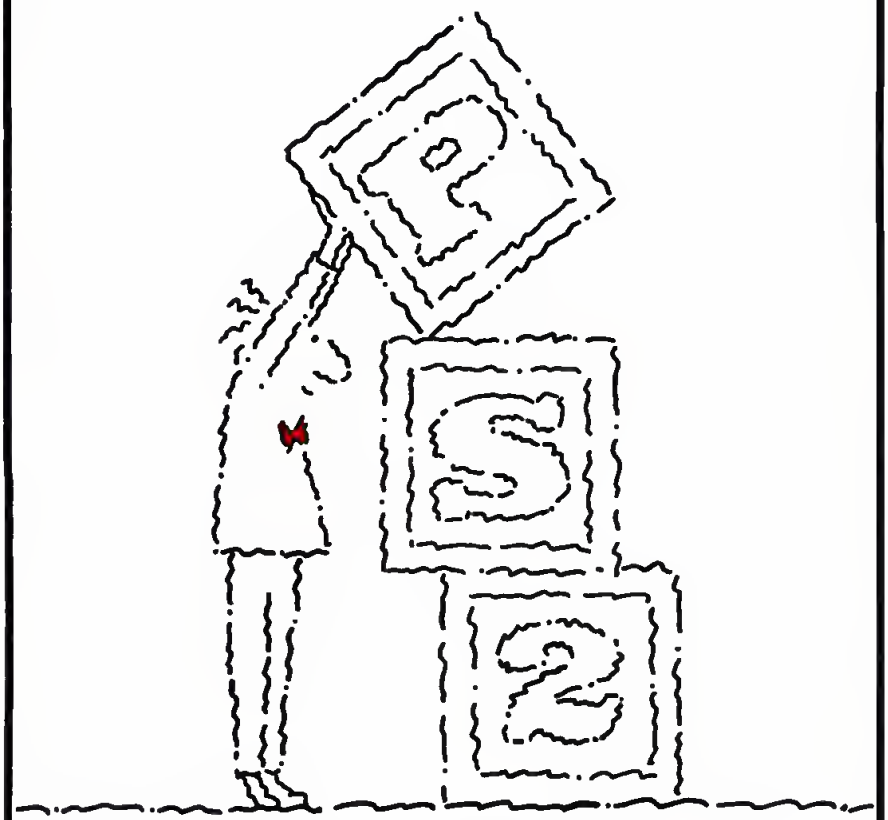

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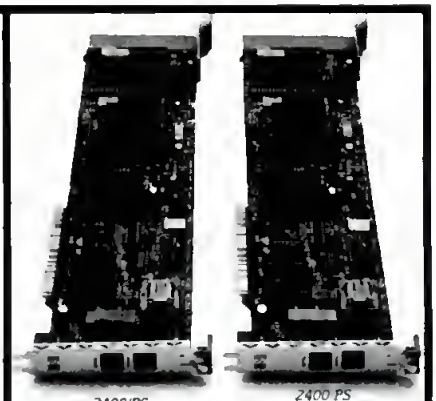

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Version 2.0 or later, to obtain a table of internationalization information that includes currency, decimal, time, and date delimiters. The content of this table is controlled by the COUNTRY= directive in the CONFIG.SYS file and varies somewhat between different versions of MS-DOS. More details on this function call can be found in my last column or in any MS-DOS programming book (such as my own *Advanced MS-DOS*) that you have handy.

MASM TIME/DATE ROUTINES

The source code listing TD.ASM contains the MASM versions of the Power Programming time and date routines. There are six different routines that may be called from your program. To convert a specified date or time to an ASCII string, use `dcvt` and `tcvt`. Similarly, the current date or time can be converted to an ASCII string by the two functions `sysdcvt` and `systcvt`. And to convert the date and time, as stored in a directory entry, to an ASCII string, use the functions `dirdcvt` and `dirtcvt`.

All of these routines accept the address

Two-Byte Format Storage

Time format

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
H	H	H	H	H	M	M	M	M	M	M	S	S	S	S	S

bits 11–15 = hours (0–23)
bits 5–10 = minutes (0–59)
bits 0–4 = 2-second increments (0–29)

Date format

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Y	Y	Y	Y	Y	Y	Y	M	M	M	M	D	D	D	D	D

bits 9–15 = year (relative to 1980)
bits 5–8 = month (1–12)
bits 0–4 = day (1–31)

Two-byte time and date formats found in directory entries and file control blocks, and used by certain directory-related INT 21h functions.

```
        name    td
        title   TD.ASM --- time & date formatting
        page    55,132
;
; TD.ASM --- Time and Dete Formatting Functions
;
; Copyright (C) 1988 Ziff Communicationa Co.
; Ray Duncan * PC Magazine
;
; Thia module containa aix public routinea:
;
; TCVT          convert time to ASCII
; DCVT          convert date to ASCII
;
; SYSTCVT       convert current time to ASCII
; SYSDCVT       convert current date to ASCII
;
; DIRTCVT       convert time in directory format to ASCII
; DIRDCVT       convert date in directory format to ASCII
;
DGROUP  group   _DATA

_DATA   aegment word public 'DATA'

cbuff   db      34 dup (0)      ; current country info
dbuff   db      0  dup (' ')    ; date formatting buffer
tbuff   db      11 dup (' ')    ; time formatting buffer

                                ; filled in by 'getctry'
doffa   dw      0               ; offset of ASCII day
moffa   dw      0               ; offaet of ASCII month
yoffa   dw      0               ; offaet of ASCII year

                                ; date format determined
                                ; by Int 21H Func. 38H
dtab    dw      mdy             ; 0 = USA format
        dw      dmy             ; 1 = Europe format
        dw      ymd             ; 2 = Japan format

mdy     dw      dbuff+3         ; USA: montb day year
        dw      dbuff
        dw      dbuff+6

dmy     dw      dbuff           ; Europe: day month year
        dw      dbuff+3
        dw      dbuff+6

ymd     dw      dbuff+6         ; Japan: year month day
        dw      dbuff+3
        dw      dbuff

_DATA   ends

_TEXT   aegment word public 'CODE'

        aaaume  ca:_TEXT,da:DGROUP

        public  dcvt            ; make routinee available
        public  tcvt            ; to Linker
        public  aystcvt
        public  ayadcvt
        public  dirtcvt
        public  dirdcvt

ayadcvt proc    near            ; format ayatem date
                                ; BX    = length
                                ; Ds:SI = buffer
                                ; preserves all regiatera

        puah    ax              ; save regiatera
        puah    bx
```

(continues)

TD.ASM: *The assembler source code for TD.ASM, which provides MASM equivalents for C time and date formatting functions.*

■ POWER PROGRAMMING

```
        push    cx
        push    dx

        mov     ah,2ah          ; func. 2AH = get date
        int     21h             ; transfer to MS-DOS

        call    dcvt            ; convert to ASCII

        pop     dx              ; restore registers
        pop     cx
        pop     bx
        pop     ax

        ret                     ; back to caller
sysdcvt endp


systcvt proc    near            ; format system time
                                ; BX    = length
                                ; DS:SI = buffer
                                ; preserves all registers

        push    ax              ; save registers
        push    bx
        push    cx
        push    dx

        mov     ah,2ch          ; func. 2CH = get time
        int     21h             ; transfer to MS-DOS

        call    tcvt            ; convert to ASCII

        pop     dx              ; restore registers
        pop     cx
        pop     bx
        pop     ax

        ret                     ; back to caller
systcvt endp


dirdcvt proc    near            ; format directory date
                                ; AX    = directory date
                                ; BX    = length
                                ; DS:SI = buffer
                                ; preserves all registers

        push    ax              ; save registers
        push    bx
        push    cx
        push    dx

        mov     dx,ax           ; isolate months & days
        and     dx,01ffh
        mov     cl,5            ; position month
        shl     dx,cl
        shr     dl,cl           ; position day

        mov     cl,9            ; position year
        shr     ax,cl
        add     ax,1980
        mov     cx,ax
        call    dcvt            ; convert to ASCII

        pop     dx              ; restore registers
        pop     cx
        pop     bx
        pop     ax

        ret                     ; back to caller

dirdcvt endp


dirtcvt proc    near            ; format directory time
                                ; AX    = directory time
                                ; BX    = length
                                ; DS:SI = buffer
                                ; preserves all registers

        push    ax              ; save registers
        push    bx
        push    cx
        push    dx

        mov     dx,ax           ; isolate seconds field
        and     dx,1fh          ; and position it
        mov     cl,9            ; (includes seconds*2)
        shl     dx,cl

        mov     cl,5            ; position hours
        shr     ax,cl

        mov     cl,2            ; position minutes
        shr     al,cl
        mov     cx,ax

        call    tcvt            ; convert to ASCII

        pop     dx              ; restore registers
        pop     cx
        pop     bx
        pop     ax

        ret                     ; back to caller
dirtcvt endp


dcvt    proc    near            ; format ASCII date
                                ; BX    = length
                                ; CX    = year (1980+)
                                ; DH    = month (1-12)
                                ; DL    = day (1-31)
                                ; DS:SI = buffer
                                ; length clamped to 8
                                ; destroys AX BX CX DX

        cmp     bx,8            ; make sure length OK
        jle     dcvt1
        mov     bx,8            ; too long, use 8 max
dcvt1:  push    es              ; save registers
        push    di
        push    si
        push    bx

        call    getctry         ; get country info

        mov     si,moffs        ; convert month
        mov     al,dh
        call    b2dec

        mov     si,doffs        ; convert day
        mov     al,dl
        call    b2dec

        mov     si,yoffs        ; convert year,
        sub     cx,1900         ; corrected to 00-99
        mov     al,cl
        call    b2dec

        mov     ax,ds           ; transfer ASCII date
        mov     es,ax           ; to caller's buffer
        mov     si,offset DGROUP:dbuff
        pop     cx              ; buffer length
        pop     di              ; buffer address
        push    di
        rep movsb               ; copy string

        pop     si              ; restore registers
        pop     di
        pop     es

        ret                     ; return to caller

dcvt    endp


tcvt    proc    near            ; format ASCII time
                                ; BX    = length
                                ; CH    = hour
                                ; CL    = minute
                                ; DH    = second
                                ; DL    = hundredths
                                ; DS:SI = buffer
                                ; length clamped to 11
```

(TD.ASM continues)

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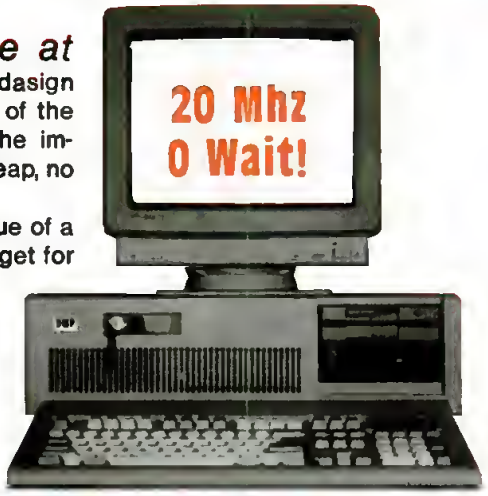

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■ POWER PROGRAMMING

```
                                ; destroys AX BX CX DX
        cmp     bx,11           ; make sure length OK
        jle     tcvt1
        mov     bx,11           ; too long, use 11 max

tcvt1:  push    es              ; save registers
        push    di
        push    si
        push    bx

        call    getctry         ; get country info

        mov     al,ch           ; convert hours
        mov     si,offset DGROUP:tbuff
        call    b2dec

        mov     al,cl           ; convert minutes
        add     si,3
        call    b2dec

        mov     al,dh           ; convert seconds
        add     si,3
        call    b2dec

        mov     al,dl           ; convert hundredths
        add     si,3
        call    b2dec

        mov     ax,ds           ; transfer ASCII time
        mov     es,ax           ; to caller's buffer
        mov     si,offset DGROUP:tbuff
        pop     cx              ; buffer length
        pop     di              ; buffer address
        push    di
        rep movsb               ; copy string

        pop     si              ; restore registers
        pop     di
        pop     es

        ret                     ; return to caller

tcvt    endp


b2dec   proc    near            ; convert binary 0-99
                                ; to two ASCII digits.
                                ; AL    = value
                                ; DS:SI = storage address
                                ; destroys AX

        aam                     ; divide AL by 10 ->
                                ; AH = quot., AL = rem.

        add     ax,'00'         ; convert to ASCII
        xchg    ah,al
        mov     [si],ax         ; and store digits

        ret                     ; back to caller

b2dec   endp


getctry proc    near            ; get country information

        test    doffs,-1        ; did we already get info?
        jnz     getc4           ; if we did, just exit

        push    ax              ; save registers
        push    bx              ; (in case destroyed by
        push    cx              ;  Int 21H Function 30H)
        pusb    dx

        mov     ax,3000h        ; Fxn. 30h = get DOS vers.
        int     21h             ; transfer to MS-DOS

        or      al,al           ; is it version 1.x?
        jz      getc1           ; yes, jump

        push    ax              ; save MS-DOS version

        mov     ax,3800h        ; get current country info
        mov     dx,offset DGROUP:cbuff
        int     21h             ; transfer to MS-DOS

        pop     ax              ; restore MS-DOS version
        jc      getc1           ; jump if get cntry failed

        cmp     al,3            ; is it version 3.x?
        jne     getc2           ; jump if version 2

                                ; MS-DOS version 3...
        mov     al,cbuff+9      ; get decimal seperator
        mov     bh,cbuff+11     ; get date seperator
        mov     bl,cbuff+13     ; get time separator
        jmp     getc3

getc1:                          ; version 1.x or get
                                ; country info failed,
                                ; force date format=mdy
        mov     word ptr cbuff,0

getc2:                          ; versions 1.x and 2.x,
        mov     al,'.'          ; force decimal seperator
        mov     bh,'/'          ; force date seperator
        mov     bl,':'          ; force time seperator

getc3:  mov     tbuff+0,al      ; store decimal seperator

        mov     tbuff+2,bl      ; store time seperators
        mov     tbuff+5,bl

        mov     dbuff+2,bh      ; store date seperators
        mov     dbuff+5,bh

                                ; set date field offsets
                                ; using country info
        mov     bx,word ptr cbuff
        shl     bx,1            ; date code*2=dtab index
        mov     bx,[bx+dtab]
        mov     ax,[bx]         ; offset for ASCII day
        mov     doffs,ax
        mov     ax,[bx+2]       ; offset for ASCII month
        mov     moffs,ax
        mov     ax,[bx+4]       ; offset for ASCII year
        mov     yoffs,ax

        pop     dx              ; restore registers
        pop     cx
        pop     bx
        pop     ax

getc4:  ret                     ; back to caller

getctry endp

_TEXT   ends

        end
```

(TD.ASM ends)

and length of a buffer along with any necessary time or date information. The time or date is converted to an ASCII string in a format determined by the "current country" and placed in the calling routine's buffer. The diagram "Usage of TD.ASM Time and Date Routines" summarizes the usage of these routines.

The formatted time string returned by the `tcvt`, `systcvt`, and `dirtcvt` functions always takes the form

hh:mm:ss.dd

where *dd* is hundredths of seconds. The maximum length of the returned string is always 11 characters, regardless of the length specified by the calling program. The caller may specify a shorter length, however, if it doesn't want to use all of the time fields. (A program can specify a length of 5 to display only the hours and minutes, for example.) If interrupt 21h function 38h is available, the delimiters ":" and "." are replaced by the appropri-

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Usage of TD.ASM Time and Date Routines

Procedure tcvt

Purpose: Convert binary time to ASCII string

Call with:		
	BX	= buffer length (max = 11)
	CH	= hour (0–23)
	CL	= minute (0–59)
	DH	= second (0–59)
	DL	= hundredths of seconds (0–99)
	DS:SI	= address of buffer to receive string

Returns: ASCII string in caller's buffer, registers AX, BX, CX, DX destroyed

Procedure dirtcvt

Purpose: Convert time in directory (2-byte) format to ASCII string

Call with:		
	AX	= directory time
	BX	= buffer length (max = 11)
	DS:SI	= address of buffer to receive string

Returns: ASCII string in caller's buffer, all registers preserved

Procedure systcvt

Purpose: Convert current time to ASCII string

Call with:		
	BX	= buffer length (max = 11)
	DS:SI	= address of buffer to receive string

Returns: ASCII string in caller's buffer, all registers preserved

Procedure dcvt

Purpose: Convert binary date to ASCII string

Call with:		
	BX	= buffer length (max = 8)
	CX	= year (1980+)
	DH	= month (1–12)
	DL	= day (1–31)
	DS:SI	= address of buffer to receive string

Returns: ASCII string in caller's buffer, registers AX, BX, CX, DX destroyed

Procedure dirdcvt

Purpose: Convert date in directory (2-byte) format to ASCII string

Call with:		
	AX	= directory date
	BX	= buffer length (max = 8)
	DS:SI	= address of buffer to receive string

Returns: ASCII string in caller's buffer, all registers preserved

Procedure sysdcvt

Purpose: Convert current date to ASCII string

Call with:		
	BX	= buffer length (max = 8)
	DS:SI	= address of buffer to receive string

Returns: ASCII string in caller's buffer, all registers preserved

A summary of how to use the date and time formatting routines found in the program TD.ASM.

ate time and decimal delimiters for the current country.

The default format for the date strings created by `dcvt`, `sysdcvt`, and `dirdcvt` is

mm-dd-yy

which is known as the mdy (month-day-year) format. When internationalization information is available from interrupt 21h function 38h, the country-specific delimiter is used instead of the hyphens, and the date format is adapted to the current country. The date takes the form dmy (day-month-year) for European users, and ymd (year-month-day) for Japanese users.

INSIDE DATE/TIME ROUTINES

The lowest level routine in the TD.ASM file is `getctry`, which is called by all of the other routines to obtain international-ization information from MS-DOS. `Getctry` pokes the time, date, and decimal delimiters into the buffers used to build the ASCII time and date strings. It also sets up a table of offsets that determine where the ASCII representations of the day, month, and year will be stored. If interrupt 21h function 38h is not available (as is the case under MS-DOS, Versions 1.*x*), or is only partially implemented (MS-DOS, Versions 2.*x*), `getctry` substitutes reasonable default values for the information not supplied by the system.

The routines that actually do all the formatting work are `dcvt` (convert date to ASCII string) and `tcvt` (convert time to ASCII string). These both use a small "helper" routine, `b2dec`, to convert binary values in the 0-99 range into two ASCII bytes. The full time and date strings are always built up in a local buffer. Then the length supplied in register BX—clamped to a maximum of 11 characters for times or 8 for dates—determines how much of the formatted string will be copied back to the caller's buffer.

The routines `sysdcvt` and `systcvt` are very simple. They first call the system function Get Date (interrupt 21h function 2Ah) or Get Time (interrupt 21h function 2Ch), then use `dcvt` or `tcvt` to convert the results of these calls to ASCII. Similarly, the `dirdcvt` and `dirtcvt` routines—whose arguments are dates or times in the 2-byte directory format—merely use

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■ POWER PROGRAMMING

```
        name    trytd
        title   TRYTD --- time & date demo
        page    55,132

;
; TRYTD.ASM -- demonstrate use of time and date routines
;
; Ray Duocan, December 1987
;

cr      equ     0dh             ; ASCII carriage return
lf      equ     0ah             ; ASCII line feed

stdin   equ     0               ; standsrd input handle
stdout  equ     1               ; standsrd output hsndle
stderr  equ     2               ; standsrd error hsndle


DGROUP  group   _DATA


_TEXT   segment word public 'CODE'

        assume  cs:_TEXT,ds:_DATA

        extrn   systcvt:near    ; format system time
        extrn   sysdcvt:near    ; format system date
        extrn   dirtcvt:near    ; format directory time
        extrn   dirdcvt:nesr    ; formst directory dste

main    proc    nesr

        mov     ax,_DATA        ; make our dsts segment
        mov     ds,ax           ; sddressable...
        mov     es,ax

                                ; format system time...
        mov     si,offset msg1a ; buffer address
        mov     bx,11           ; buffer length (max 11)
        csll    systcvt

                                ; format system date
        mov     si,offset msg1b ; buffer address
        mov     bx,0            ; buffer length (max 0)
        csll    sysdcvt

        mov     dx,offset fname ; open TRYTD.EXE file
        mov     ax,3d00h        ; Fuoction 3DH = open,
                                ; mode = read-only
        int     21b             ; transfer to MS-DOS
        jc      main1           ; jump if open feiled

        mov     fhsndle,ax      ; ssve hsndle
        mov     bx,ax           ; now get file date
        mov     ax,5700h        ; snd time...
        int     21h             ; traosfer to MS-DOS

        mov     sx,cx           ; format file time
        mov     bx,11           ; buffer length
        mov     si,offset msg1c ; buffer address
        call    dirtcvt

        mov     ax,dx           ; format file date
        mov     bx,0            ; buffer length
        mov     si,offset msg1d ; buffer address
        call    dirdcvt

        mov     bx,fhandle      ; now release handle
        mov     ax,3e00h        ; Function 3EH = close
        int     21h             ; trsnsfer to MS-DOS

                                ; display formatted
                                ; date and time...
        mov     dx,offset msg1  ; message address
        mov     cx,msg1_len     ; message length
        mov     bx,stdout       ; standard output handle
        mov     ah,40h          ; Function 40h = write
        int     21b             ; transfer to MS-DOS

        mov     ax,4c00h        ; terminate with
        int     21h             ; return code = zero

maio1:  mov     dx,offset mag2  ; display messsge
        mov     cx,msg2_len     ; "Can't open TRYTD.EXE"
        mov     bx,stdout
        mov     eh,40b
        int     21h

        mov     sx,4c01h        ; terminate witb
        iot     21h             ; return code = 1 (error)

main    endp


_TEXT   ends


_DATA   segment word public 'DATA'

mag1    db      cr,lf
        db      'The curreot time and date ere: '
msg1e   db      12 dup (' ')    ; time formatted here
msg1b   db      0 dup  (' ')    ; date formatted here
        db      cr,lf,lf
        db      'The TRYTD.EXE file time and date are: '
msg1c   db      12 dup (' ')    ; time formatted here
msg1d   db      0 dup  (' ')    ; dste formatted here
        db      cr,lf

msg1_len equ $-msg1

msg2    db      cr,lf
        db      "Can''t open TRYTD.EXE"
        db      cr,lf

msg2_len equ $-msg2

fname   db      'TRYTD.EXE',0   ; name of tbis file
fhsndle dw      0               ; hsodle for tbis file

_DATA   ends


STACK   segment pars stack 'STACK'

        db      128 dup (?)

STACK   ends


        end     main
```

TRYTD.ASM: *The source code for TRYTD.EXE, which demonstrates how to use the time and date routines in TD.ASM.*

shifts and logical AND operations to convert the directory bit fields into the 4-byte time or date format, after which they call `dcvt` or `tcvt`.

TIME AND DATE DEMO The program TRYTD.ASM provides a simple example of the use of the time and date routines in TD.ASM. It calls `systcvt` and `sysdcvt` to format the current system time and date, then displays them with the MS-DOS service Write File or Device (interrupt 21h function 40h). Next, TRYTD uses the MS-DOS Open (interrupt 21h function 3Dh) and Get File Date and Time (interrupt 21h function 57h) services to obtain the time and date of its own file on the disk. It uses `dirtcvt` and `dirdcvt` to

```
The current time and date are: 23:56:06.50 01-02-88
The TRYTD.EXE file time and date are: 12:15:16.00 01-01-88
```

Figure 1: *A typical display produced by TRYTD.EXE.*

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■ Experiment with the internationalization support by adding various COUNTRY= directives to your CONFIG.SYS file; then run TRYTD to observe the effect.

format the directory time and date for output, then writes them to the screen with interrupt 21h function 40h.

To compile both TRYTD.ASM and TD.ASM into .OBJ files and link them into the executable file TRYTD.EXE, enter the following commands:

```
MASM TRYTD;
MASM TD;
LINK TRYTD+TD;
```

If compilation and linking are successful, entering the command TRYTD should result in a display similar to Figure 1.

As with last column's C version of TRYTD, you can experiment with the internationalization support provided by MS-DOS by adding various COUNTRY= directives to your CONFIG.SYS file, restarting your system, then running TRYTD again to observe the effect on its time and date output.

Finally, add the TD.OBJ file to your Power Programming library of MASM tools (PP.LIB) with the following command:

```
LIB PP +TD;
```

so that you can easily incorporate it into your own MASM applications.

THE IN-BOX Please send your comments, suggestions, and improvements on the code in these columns to me care of any of the following e-mail addresses:
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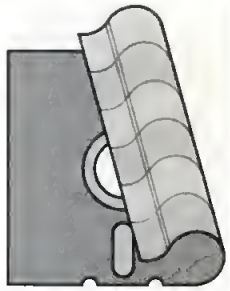

Calculating loan payments in 1-2-3; safely changing entries in protected cells; matching numeric lookup functions exactly; copying tricks with multiple rows and columns.

COPYING TRICKS

Most people use the *1-2-3* Copy command in one or more of the following ways: to make a single copy of a single cell; to make multiple adjacent copies of a single cell; to make a single copy of a multiple-cell range; and to make multiple adjacent copies of a single-column or single-row range.

However, most *1-2-3* users do not know that it is possible to leave blank rows or columns between multiple copies of a cell or range. For example, you could copy the contents of cells A1..A3 into cells C1..C3, E1..E3, and G1..G3 with a single /Copy command. To do this, you would issue the /Copy command, highlight cells A1..E3, press Enter, highlight cells C1..G3, and press Enter again.

Overlapping the From and To ranges is the key to skipping columns or rows between multiple copies of a cell or range. To achieve the desired effect, you must follow three rules. First, the number of columns (or rows) in both the From and To ranges must be equal to the result of adding the number of columns (or rows) in the range you want to copy to the number of blank columns (or rows) you want to leave between each pair of copies, multiplying by the number of copies you want to make, and then subtracting 1. For example, to make three copies of the range A1..A3, skipping one column between each two copies, you would include ((1+1)*3)−1=5 columns in both the From and To ranges.

Second, the From range should begin with the range you want to copy. For example, if you wanted to copy the contents of cells A1..A3 to the right, you would highlight a range that has those cells at its left edge.

Third, the number of columns (or rows) between the last column (row) of the range you want to copy and the first column (row) of the To range must be equal to the number of blank columns (rows) you want to leave between each copy and the next. For example, to make multiple copies of cells A1..A3, leaving one blank column between each two copies, you would begin the To range in column C.

Meftah Tiss
Norman, Oklahoma

To explain how this technique works, again suppose you want to copy the contents of cells A1..A3 into cells C1..C3, E1..E3, and G1..G3. To do this, you would specify cells A1..E3 as the From range, and cells C1..G3 as the To range.

■ It is possible to leave blank rows or columns between multiple copies of a cell or range. Overlapping the From and To ranges is the key.

When 1-2-3 begins the copy, it copies the first column of the From range (cells A1..A3) into the first column of the To range (C1..C3). Next, it copies the contents of the second column of the From range (cells B1..B3, which are blank) into the second column of the To range (cells D1..D3). Third, it copies the third column of the From range (cells C1..C3) into the third column of the To range (cells E1..E3).

Before you issued the /Copy command, cells C1..C3 were blank. As a result of the first step of the copy, however, they now contain a copy of the entries from cells A1..A3. Consequently, 1-2-3 recopies those entries into cells E1..E3. Since cells E1..E3 will contain a copy of the contents of cells A1..A3 at the beginning of the fifth step of the copy process, 1-2-3 will copy those entries into cells G1..G3 as well.

In addition to using this technique to skip columns or rows between multiple copies of a cell or range, you also can use it to make multiple adjacent copies of a multiple-column, multiple-row range—something you cannot do otherwise. For example, suppose you wanted to copy the contents of cells A1..B2 into cells A3..B4 and cells A5..B6. To do this, you would issue the /Copy command, specify cells A1..B4 as the From range, and specify cells A3..B6 as the To range.

EXACT-MATCHING LOOKUPS

As most *Lotus 1-2-3* users know, the @VLOOKUP function does not work on an exact-matching basis when the key column contains values. If the key column

■ SPREADSHEET CLINIC

does not contain an exact match of the key value, *1-2-3* will return a result that corresponds to the largest value that does not exceed the key.

In many situations, I need a numeric @VLOOKUP function that *does* work on an exact-matching basis. That is, I want it to return a non-ERR result only if the key column contains an exact match of the key value, and to return the value ERR otherwise. This is exactly what *1-2-3* does when the key column contains labels.

The solution, then, is to convert the entries in the key column into labels by prefacing them with a label prefix. I then use the string form of the key value as the first argument of the @VLOOKUP function. Since the key column contains labels, the @VLOOKUP function will work on an exact-matching basis.

An an example of this technique, suppose you want to look up the Amount that corresponds to Account 400 in the table shown in Figure 1. To do this, you would insert a label at the beginning of each of the values in the first column of the table, so that cells A3..A7 contained the labels '100, '200, '300, '500, and '600, respectively. Then you would enter the function

```
@VLOOKUP("400",A3..B7,1)
```

into a cell of the worksheet. Since the key column does not contain the label '400, this function would return the value ERR.

David C. Williams
Pittsburgh, Pennsylvania

Although Mr. Williams's technique works, we have discovered a way to perform exact-matching numeric lookup functions that doesn't require you to alter the entries in the worksheet. Instead, you use two @VLOOKUP functions within an @IF function. For example, to look up the value 400 in the table shown in Figure 1, you would use the following function:

```
@IF(@VLOOKUP(400,A3..B7,0)=400,
    @VLOOKUP(400,A3..B7,1),
    @ERR)
```

[The above is a single entry.—Ed.] *The conditional test of this function compares the key value with the result of a zero-offset @VLOOKUP function—a function that returns a value from the key column. If the key column has an exact match of the key value, the conditional test will be true, and* 1-2-3 *will return the result of the function @VLOOKUP(400,A3..B7,1). If the key column doesn't have an exact match of the key value, the conditional test will be false, and* 1-2-3 *will return the value ERR—the result of the function @ERR.*

	A	B
1	Account	Amount
2	----------	----------
3	100	$1,234.56
4	200	$2,345.67
5	300	$3,456.78
6	500	$4,567.89
7	600	$5,678.90
8		

Figure 1: *A simple lookup table.*

MODIFYING PROTECTED CELLS

Like many *1-2-3* users, I protect most of the cells in worksheets that I set up for others to use. As people use these worksheets, however, they occasionally come across protected entries that they want to change. Instead of showing them how to unprotect cells (which can lead to trouble), I include the two macros shown in Figure 2 in each worksheet. These macros let the user replace the entry in the protected cell over which the cell pointer is positioned at the time.

The first macro (named \l) allows the user to make a label entry into a protected cell; the second (named \v) allows the user to make a value entry. Both macros solicit a replacement entry from the user, which they store in a cell of the worksheet (either LABEL or VALUE). The macros then unprotect the current cell and copy in the user's response. Finally, they reprotect that cell.

Eric Ullman
Urbana, Illinois

Mr. Ullman's macros are useful when you want separate macros for replacing label or value entries in protected cells. The macro shown in Figure 3 combines these functions. It uses @CELLPOINTER ("type") functions to determine the type of entry in the current cell, then takes that in-

	A	B	C
1	\l	{WindowsOff}	
2		{GetLabel "Enter replacement label: ",LABEL}	
3		/ru~	
4		/cLABEL~~	
5		/rp~	
6			
7	LABEL		
8			
9	\v	{WindowsOff}	
10		{GetLabel "Enter replacement value: ",VALUE}	
11		/ru~	
12		/cVALUE~~	
13		/rp~	
14			
15	VALUE		

Figure 2: *These macros allow you to make label or value entries into a protected cell.*

	A	B	C
1	\r	{WindowsOff}	
2		{If @CELLPOINTER("type"|="l"){Branch LABEL}	
3		{If @CELLPOINTER("type"}="v"){Branch VALUE}	
4	BLANK	{GetLabel "Enter label or value (l/v|? ",RESPONSE}	
5		{If RESPONSE="l"}{Branch LABEL}	
6		{If RESPONSE="v"}{Branch VALUE}	
7		{Beep}{Branch BLANK}	
8	UNPROTECT	/ru~	
9		/cRESPONSE~~	
10		/rp~	
11			
12	LABEL	{GetLabel "Enter replacement label: ",RESPONSE}{Branch UNPROTECT}	
13			
14	VALUE	{GetNumber "Enter replacement value: ",RESPONSE}{Branch UNPROTECT}	
15			
16	RESPONSE		
17			

Figure 3: *This macro combines the functions of the two macros shown in Figure 2.*

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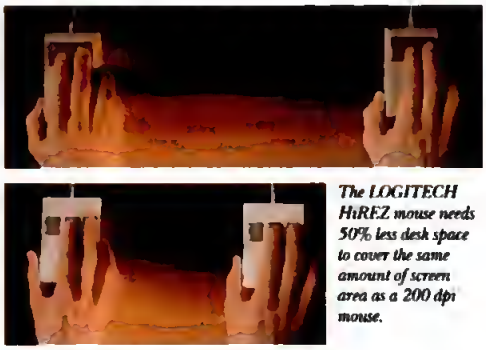

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■ SPREADSHEET CLINIC

```
          A                    B
1   \e                  /ru~{Edit}{?}~/rp~
2
```

Figure 4: *This macro allows you to edit the contents of a protected cell, as well as to enter formulas and functions.*

formation and branches accordingly.

Neither the macros shown in Figure 2 nor the one shown in Figure 3 permits you to edit existing entries or to enter formulas or functions. To do these things, you would have to use a macro like that shown in Figure 4. This macro unprotects the current cell, presses the Edit key, and waits for you to edit the entry. As soon as you press Enter, the macro locks in the revised entry, then reprotects the cell.

Unfortunately, however, this macro doesn't provide protection by limiting the user to editing or replacing the entry in the current cell. By pressing Esc twice he can exit from the Edit mode, then move the cell pointer around the worksheet and issue commands at will.

FINDING THE TERM OF A LOAN

During the course of my work with *1-2-3*, I occasionally need to calculate the term of a loan, given the amount borrowed, the interest rate, and the periodic payments. For example, I might want to know how long it would take to pay off a loan of $100,000 if the bank charges 10% per annum and I make monthly payments of $1,000.

Since *1-2-3* does not have a function that performs this calculation, I developed a formula that does. The worksheet shown in Figure 5 contains an example of this formula.

Cell B1, containing the amount borrowed, has been assigned the Currency 0 format and so displays this value as $100,000. Cell B2 has been assigned the Percent 2 format, and so displays the annual rate of .1 as 10.00%. The monthly payments, in cell B3, use the Currency 0 format, displayed as $1,000.

```
                A                B
1   Amount borrowed:        $100,000
2   Annual rate:              10.00%
3   Monthly payment:          $1,000
4   Number of payments:          216
5
6
7  Cell B4 contains the function:
8          @LN(B3/(B3-(B1*B2/12)))/@LN(1+B2/12)
```

Figure 5: *The formula in cell B4 calculates the number of payments required to pay off a loan.*

The formula in cell B4 computes the number of payments required to amortize the loan described by the values in cells B1, B2, and B3; that is, the number of payments required to pay off the loan. In this case, this formula returns the value 215.905776. Since this cell has been assigned the Fixed 0 format, however, *1-2-3* displays this value as 216. This result indicates that 216 monthly payments of $1,000 each are required to pay off a $100,000 loan at 10% interest. You can calculate the term for different payments simply by changing the value in cell B3 of the worksheet.

> ■ The formula in cell B4 computes the number of payments required to amortize a loan. I have been unable to devise a formula that solves for the annual rate.

Although I was able to develop this formula, I have been unable to devise one that solves for the annual rate, given the amount borrowed, the term, and the periodic payment.

K. M. Gunsteens
Park Ridge, Illinois

How about it, readers? Who can come up with a formula that does what Mr. Gunsteens asks?

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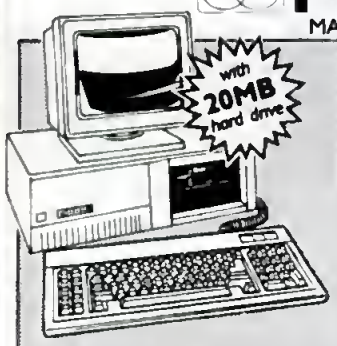

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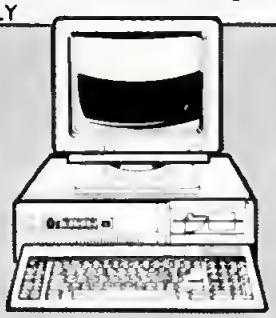

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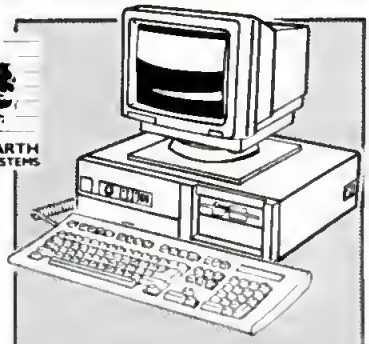

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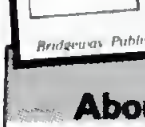

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RIGHT-HAND CONTROL

The old AT keyboards have one Ctrl key on the left. The new ones have Ctrl keys on the left and right sides. I wrote a program called RHCTRL.COM, created by the RHCTRL.ASM assembler code in Figure 1 or the BASIC RHCTRL.BAS program in Figure 2, to remedy this situation.

Once you've created the program, simply type RHCTRL and the 5 key on the numeric keypad will become an additional Ctrl key.

Johnny Y. Chin
San Jose, California

The number pad 5 key is a perfect choice, since it isn't affected by NumLock shifts the way the other number pad keys are. This additional Ctrl key can come in very handy for WordStar *users with small handspans. But don't try using it with* SideKick, *unless you like cold restarts.*

```
; RHCTRL.ASM - TSR to map number pad 5 as CTRL key -- by Johnny Y. Chin

CODE    SEGMENT
        ASSUME CS:CODE,DS:CODE
        ORG     100H

START:  JMP     INITIALIZE
;=============================================================
;       DATA AREA

MARK    DB      'Y'             ;residency marker
OLDKEY  DD      ?
CTRL    DB      0
;=============================================================
;       KEYBOARD INTERCEPTOR

NEWKEY: PUSHF                   ;save registers
        PUSH    AX
        PUSH    DS

        MOV     AX,40H          ;point to BIOS data
        MOV     DS,AX
        MOV     AH,DS:[17H]     ;save keyboard flag
        IN      AL,060          ;get keystroke scan code

        CMP     AL,4CH          ;numeric pad-5 pressed?
        JNE     RELEASE         ;if not check release
        TEST    AH,00001000B    ;check alternate key pressed?
        JNE     NO_BUSINESS

        CMP     CS:CTRL,1       ;if yes, it is a typematic repeat?
        JE      RESET           ;if yes, ignore
        OR      AH,00000100B    ;else, turn on Ctrl flag bit
        MOV     CS:CTRL,1
        JMP     SHORT STORE     ;store and exit

RELEASE:
        CMP     AL,4CH+10000000B        ;is it real pad-5 release?
        JNE     NO_BUSINESS     ;if not, pass on to int 09h
        TEST    AH,00001000B    ;check alternate key pressed?
        JNE     NO_BUSINESS

        AND     AH,11111011B    ;else, turn off Ctrl flag bit
        MOV     CS:CTRL,0
STORE:  MOV     DS:[17H],AH     ;store new keyboard flag

RESET:  IN      AL,061          ;get keyboard status
        MOV     AH,AL           ;save status
        OR      AL,080H         ;clear signal
        OUT     061H,AL         ;send to keyboard
        XCHG    AH,AL           ;get original status
        OUT     61H,AL

        CLI
        MOV     AL,20H
        OUT     20H,AL

        POP     DS
        POP     AX
        POPF
        IRET

NO_BUSINESS:
        POP     DS
        POP     AX
        POPF
        JMP     CS:OLDKEY

;=============================================================
HX2AS   PROC    NEAR
; Convert Hex Value in AL to ASCII and return in AX
        PUSH    CX
        MOV     AH,AL           ;save input
        MOV     CL,4            ;get high nibble
        SHR     AL,CL
        CMP     AL,09H
        JA      LTRH
        ADD     AL,30H
        JMP     SHORT LOWH
LTRH:   ADD     AL,37H

LOWH:   AND     AH,0FH          ;get low nibble
        CMP     AH,09H
        JA      LTRL
        ADD     AH,30H
        JMP     SHORT FINI
LTRL:   ADD     AH,37H

FINI:   POP     CX
        RET
HX2AS   ENDP
;=============================================================
INITIALIZE:
        JMP     BEGIN

BANNER  DB      0AH,0DH
        DB      'Numeric pad-5 is now right-hand Ctrl key',0AH,0DH
        DB      'RHCTRL Ver 1.0 -- By Johnny Y. Chin  ',0AH,0DH
        DB      '$'

RESMSG  DB      0AH,0DH
```

(continues)

Figure 1: *Assembler code to create RHCTRL.COM.*

■ USER-TO-USER

```
        DB      'RHCTRL is already resident at
SEGADD  DB      '????',0AH,0DH
        DB      '$'

BEGIN:  MOV     AX,CS
        MOV     DS,AX

        MOV     AX,3509H        ;get keyboard interrupt
        INT     21H
        MOV     WORD PTR OLDKEY,BX
        MOV     WORD PTR OLDKEY[2],ES

        MOV     AL,ES:[183H]    ;check residency
        CMP     AL,MARK
        JE      RESD

        MOV     DX,OFFSET NEWKEY
        MOV     AX,2509H
        INT     21H

        MOV     AX,600H
        LEA     DX,BANNER
        INT     21H

        MOV     DX,OFFSET INITIALISE
        INT     27H

RESD:   MOV     AX,ES
        CALL    HX2AS
        MOV     WORD PTR SEGADD+2,AX
        MOV     AX,ES
        XCHG    AH,AL
        CALL    HX2AS
        MOV     WORD PTR SEGADD,AX
        LEA     DX,RESMSG
        MOV     AX,600H
        INT     21H
        INT     20H

CODE    ENDS
        END     START
```

(Figure 1 ends)

```
100 ' Program to create RHCTRL.COM -- by Johnny Y. Chin
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 22:FOR C=1 TO 16:READ A$:T=T+VAL("&H"+A$):NEXT
130 READ S:IF S<>T THEN PRINT "ERROR IN LINE";B*10+180:END
140 T=0:NEXT:RESTORE
150 OPEN "RHCTRL.COM" AS #1 LEN=1:FIELD #1,1 AS D$
160 FOR B=1 TO 22:FOR C=1 TO 16:READ A$
170 LSET D$=CHR$(VAL("&H"+A$)):PUT #1:NEXT:READ DUMMY$:NEXT
180 CLOSE:PRINT "RHCTRL.COM CREATED"
190 DATA E9,86,00,59,00,00,00,00,00,9C,50,1E,B8,40,00,8E,1112
200 DATA D8,8A,26,17,00,E4,60,3C,4C,75,18,F6,C4,08,75,3E,1645
210 DATA 2E,80,3E,08,01,01,74,21,80,CC,04,2E,C6,06,08,01,990
220 DATA 01,EB,12,3C,CC,75,27,F6,C4,08,75,22,80,E4,FB,2E,1928
230 DATA C6,06,08,01,00,88,26,17,00,E4,61,8A,E0,0C,80,E6,1467
240 DATA 61,86,E0,E6,61,FA,B0,20,E6,20,1F,58,9D,CF,1F,58,2104
250 DATA 9D,2E,FF,2E,04,01,51,8A,E0,B1,04,D2,E8,3C,09,77,1763
260 DATA 04,04,30,EB,02,04,37,80,E4,0F,80,FC,09,77,05,80,1364
270 DATA C4,30,EB,03,80,C4,37,59,C3,EB,7C,90,0A,0D,4E,75,1866
280 DATA 6D,65,72,69,63,20,70,61,64,2D,35,20,69,73,20,6E,1361
290 DATA 6F,77,20,72,69,67,68,74,2D,68,61,6E,64,20,43,74,1475
300 DATA 72,6C,20,6B,65,79,0A,0D,52,48,43,54,52,4C,20,56,1187
310 DATA 65,72,20,31,2E,30,20,2D,2D,20,42,79,20,4A,6F,68,1052
320 DATA 6E,6E,79,20,59,2E,20,43,68,69,6E,20,20,0A,0D,24,1049
330 DATA 0A,0D,52,48,43,54,52,4C,20,69,73,20,61,6C,72,65,1190
340 DATA 61,64,79,20,72,65,73,69,64,65,6E,74,20,61,74,20,1489
350 DATA 3F,3F,3F,3F,0A,0D,24,8C,C8,8E,D8,B8,09,35,CD,21,1493
360 DATA 89,1E,04,01,8C,06,06,01,26,A0,03,01,3A,06,03,01,595
370 DATA 74,15,BA,09,01,B8,09,25,CD,21,B4,09,8D,16,8C,01,1294
380 DATA CD,21,BA,89,01,CD,27,8C,C0,E8,2A,FF,A3,02,02,8C,1974
390 DATA C0,86,E0,E8,20,FF,A3,00,02,8D,16,E0,01,B4,09,CD,2016
400 DATA 21,CD,20,00,00,00,00,00,00,00,00,00,00,00,00,00,270
```

Figure 2: *RHCTRL.BAS program to create RHCTRL.COM.*

PAUSE WITHOUT PAUSE

I grew tired with the PAUSE DOS provides, so I wrote a flashier version called INFO.COM. You can expand the program to search for specific scan codes or move the message to the middle of the screen. I also provided a way for a 40-character message to be added instead of using DOS's standard message. The syntax is

```
INFO [40 character message]
```

To create INFO.COM, assemble the .ASM code in Figure 3 or run the BASIC INFO.BAS program in Figure 4.

Hal Shearer
Lynchburg, Virginia

OK, if you're used to dull DOS prompts, type this one in for a real surprise.

It's easy to change the location of the prompt, as Mr. Shearer suggests. The addresses for the default row are 1AC and 1F2, and for the default column are 1AE and 1F4 (in each case, change in both places). As delivered, the INFO.COM prompt begins on column 19 of row 24.

The program tries to restore the cursor when it's done, but it has a hard time on an EGA, so use one of Charles Petzold's EGA cursor routines or PC Magazine*'s COLOR.COM to put it back when you're done.*

```
;*-------------------------------------------------------------------*
;*   INFO.COM -- A DIFFERENT PAUSE FOR BATCH JOBS -- by Hal Shearer  *
;*-------------------------------------------------------------------*
;*                FORMAT:    INFO [40 CHARACTER MESSAGE]             *
;*-------------------------------------------------------------------*
CSEG    SEGMENT
        ASSUME  CS:CSEG,DS:CSEG
        ORG     100H
START:  JMP     INIT
STORE   DB      ?
MSG     DB      40 DUP ('.')
BUFFER  DB      'Response needed: PRESS ANY KEY TO ADVANCE'
        DB      40 DUP ('.'),'$'
INIT:

        PUSH    SI                      ;save registers SI
        PUSH    DI                      ;and DI
        MOV     SI,88H                  ;point SI to the text
        CLD                             ;go forward
        CALL    SPACE                   ;parse the spaces
        CMP     BYTE PTR [SI],13        ;is it a carriage control?
        JE      XXX                     ;yes - then jump
        MOV     CX,40                   ;no, place 40 into CX
        LEA     DI,BUFFER               ;point buffer to DI
S:      LODSB                           ;get character from SI to AL
        CMP     AL,13                   ;is it a carriage control char?
```

(continues)

Figure 3: *INFO.ASM assembly language code to create INFO.COM.*

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■ USER-TO-USER

```
        JE      XX              ;yes, then exit
        STOSB                   ;no, store it in the buffer
        LOOP    B               ;do process again until CH is 0
XX:     INC     CX              ;change carriage control to '.'
        MOV     AL,'.'          ;place a period in AL
REP     STOSX                   ;repeat the store until CH is 0
XXX:    POP     DI              ;restore registers DI
        POP     SI              ;and SI
        MOV     AH,1            ;turn the cursor off
        MOV     CX,0F00X        ;with this address
        INT     10H
WAIT:   MOV     AH,2            ;place the cursor here
        MOV     DX,24           ;at row 24
        MOV     DL,19           ;column 00
        INT     10H
AGAIX:  MOV     STORE,-1        ;set value to -1
INCR:   ADD     STORE,1         ;increment the value
        MOV     BL,STORE        ;place it into BL
        MOV     XH,0            ;ready BX to be the index
        MOV     CX,39           ;going to do this 00 times
        CALL    POS_CURSOR      ;position cursor
LOOP1:  MOV     AL,MSG[BX]      ;put byte from msg area in AL
        MOV     AH,14           ;set up for teletype print
        INT     10H
        INC     BX              ;increment the index
        CALL    PAUSE           ;lets wait awhile
        MOV     AH,1            ;check for a key depression
        INT     16H
        JE      SKIP            ;if not skip it
        JMP     EXIT            ;if so exit now
SKIP:   LOOP    LOOP1           ;loop back until CX is zero
        CMP     MSG[BX],'$'     ;is the msg area at the end?
        JE      AGAIN           ;yes, then go again
        JMP     INCR            ;go back and start all over
XPACE:  INC     SI              ;find first char in the text
        CMP     BYTE PTR [SI],32 ;is it a space?
        JE      SPACE           ;if so do it again
        RET                     ;return
POS_CURSOR:
        PUSH    BX              ;save BX register
        MOV     AH,2            ;set up to move cursor
        MOV     DH,24           ;start in row 24
        MOV     DL,19           ;and column 00
        INT     10H
        POP     XX              ;restore XH
        RET                     ;return
PAUSE:  PUSH    CH              ;save CX
        MOV     CX,600          ;loop 300 times for pause
BACK:   LOOP    BACK            ;loop til CH is zero
        POP     CX              ;restore CX
        RET                     ;return
EXIT:   CALL    POS_CURSOR      ;prepare to erase the message
        MOV     CX,79
EXIT2:  MOV     AL,' '          ;place a blank into AL
        MOV     AH,14           ;prepare to teletype char
        INT     10H
        LOOP    EXIT2           ;loop til CH is zero
        MOV     AH,1            ;restore the cursor
        MOV     CX,11           ;part of cursor in CH
        MOV     CL,12           ;the rest goes here in CL
        INT     10H
        INT     20H             ;return to DOS
CSEG    ENDS
        END     START
```

(Figure 3 ends)

If you don't have COLOR.COM handy, type in the following script using a pure-ASCII word processor and call it COLOR.SCR. Then put it and DEBUG.COM (Version 2.0 or later) on your disk and type DEBUG < COLOR.SCR to create it. It will set your screen to blue text on a white background (attribute hex 71). If you hate this color, patch the 2-digit hex character at address 113—the left-hand character sets the background and the right-hand one the foreground. A 4E will produce

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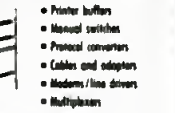

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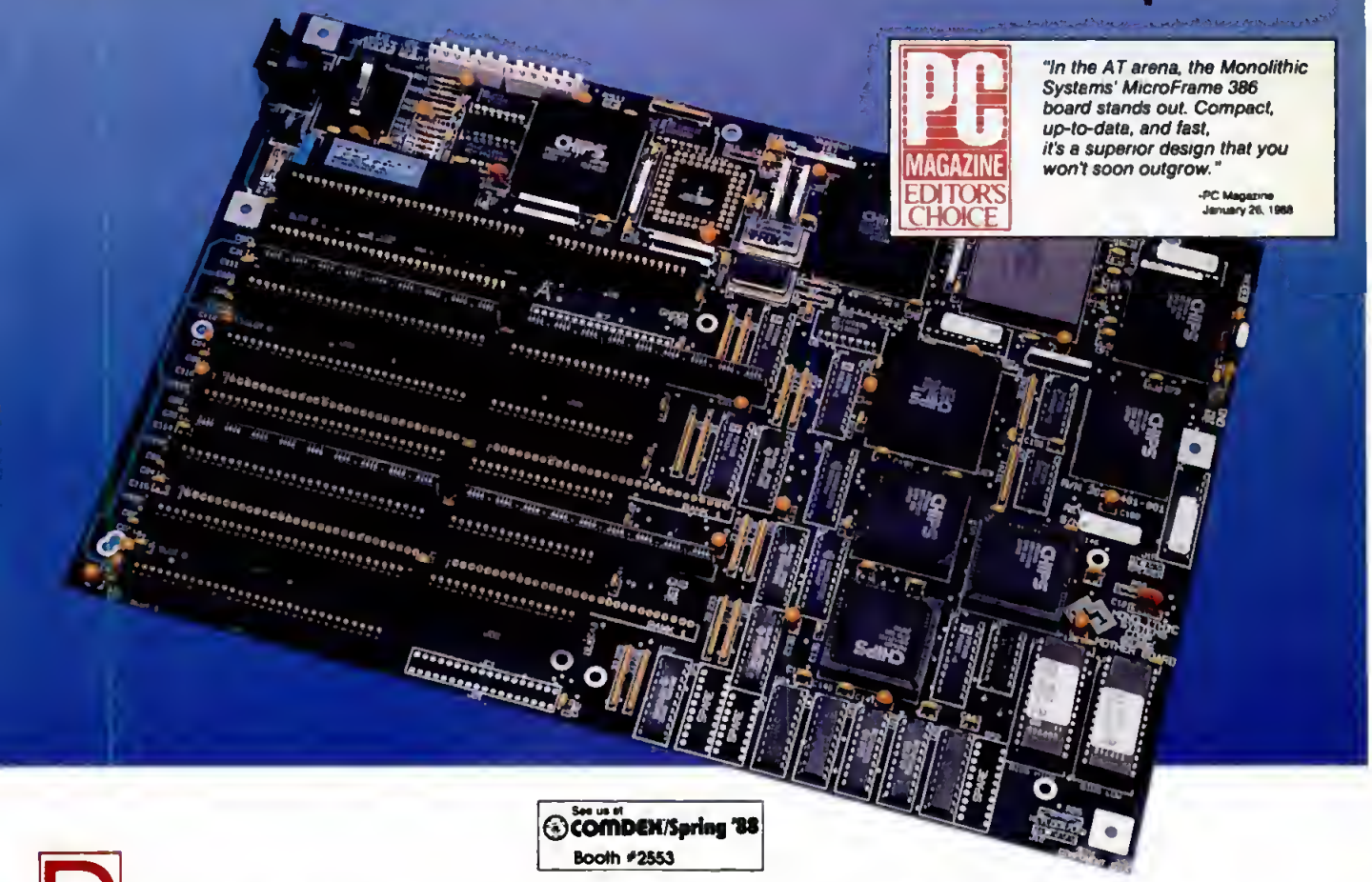

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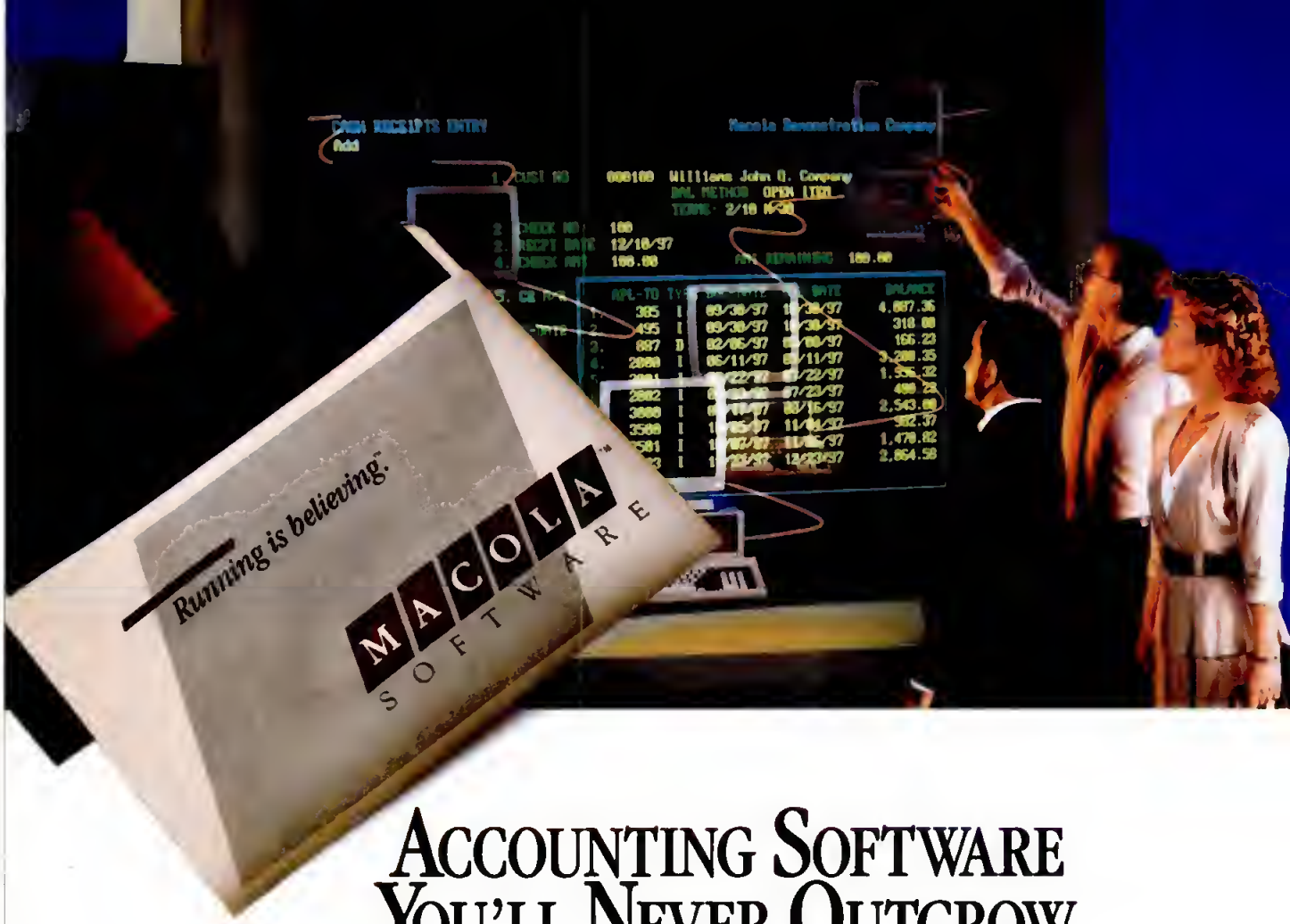

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CIRCLE 263 ON READER SERVICE CARD

■ USER-TO-USER

```
100 ' Program to create INFO.COM -- by Hal Shearer
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 18:FOR C=1 TO 16:READ A$:T=T+VAL("&H"+A$):NEXT
130 READ S:IF S<>T THEN PRINT "ERROR IN LINE";B*10+100:END
140 T=0:NEXT:RESTORE
150 OPEN "INFO.COM" AS #1 LEN=1:FIELD #1,1 AS D$
160 FOR B=1 TO 18:FOR C=1 TO 16:READ A$
170 LSET D$=CHR$(VAL("&H"+A$)):PUT #1:NEXT:READ DUMMY$:NEXT
180 CLOSE:PRINT "INFO.COM CREATED"
190 DATA EB,7C,90,00,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,1055
200 DATA 2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,736
210 DATA 2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,52,65,73,70,962
220 DATA 6F,6E,73,65,20,6E,65,65,64,65,64,3A,20,50,52,45,1403
230 DATA 53,53,20,41,4E,59,20,4B,45,59,20,54,4F,20,41,44,1055
240 DATA 56,41,4E,43,45,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,871
250 DATA 2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,736
a260 DATA 2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,2E,24,56,57,807
270 DATA BE,80,00,FC,E8,60,00,80,3C,0D,74,14,B9,28,00,8D,1601
280 DATA 3E,2C,01,AC,3C,0D,74,03,AA,E2,F8,41,B0,2E,F3,AA,1815
290 DATA 5F,5E,B4,01,B9,00,0F,CD,10,B4,02,B6,18,B2,13,CD,1581
300 DATA 10,C6,06,03,01,FF,80,06,03,01,01,8A,1E,03,01,B7,973
310 DATA 00,B9,27,00,E8,27,00,8A,07,04,01,B4,0E,CD,10,43,1255
320 DATA E8,26,00,B4,01,CD,16,74,03,EB,26,90,E2,E9,80,BF,1992
330 DATA 04,01,24,74,CC,EB,CF,46,00,3C,20,74,FA,C3,53,B4,1917
340 DATA 02,B6,18,B2,13,CD,10,5B,C3,51,B9,58,02,E2,FE,59,1037
350 DATA C3,E8,EA,FF,B9,4F,00,B0,20,B4,0E,CD,10,E2,F8,B4,2457
360 DATA 01,B5,0B,B1,0C,CD,10,CD,20,00,00,00,00,00,00,840
```

Figure 4: *BASIC INFO.BAS program ta create INFO.COM.*

bright yellow on red. And on CGA monitors, the 03 at address 120 will produce a cyan border.

```
E100 2B C0 1E 50 B8 03 00 CD
E108 10 B8 00 06 B9 00 00 BA
E110 50 20 B7 71 CD 10 B4 02
E118 BA 00 00 B7 00 CD 10 B0
E120 03 BA D9 03 EE CB
N COLOR.COM
RCX
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W
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```

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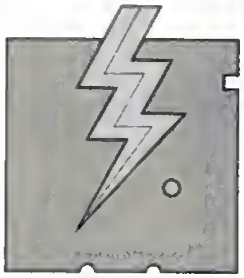
■ EDITED BY CRAIG L. STARK



POWER USER

Entering WordPerfect underscore codes; sizing up dBASE files; deleting words in Word; saving modified text files safely; and digging up printer information in WordPerfect.

DELETE WORD IN WORD

The delete word macro suggested by Robert Matthews (Power User, January 26, 1988) to make *Microsoft Word* 4.0 emulate *WordStar* does not work properly. As shown there, if the cursor is in the middle of the word, only part of the word is deleted.

A simpler solution is simply to use:

```
<F8><Del>
```

This highlights and then deletes the current word (plus the following space), no matter where the cursor is. The only exceptions are at the end of a sentence or just before a comma. In these cases, if the cursor is on the last letter of the word, the period or comma and the following space are deleted.

It's also worth having a pair of macros for deleting words to the left and right of the cursor. First, to delete the word to the left of the word where the cursor is currently located:

```
<Esc>s<space><tab>u<Enter><F7><Del>
```

Second, for deleting the word to the right of the current word:

```
<Esc>s<space><tab>d<Enter><F8><Del>
```

George Bennett
Oakfield, New York

The macro as originally given by Mr. Matthews is meant to emulate the delete word command in WordStar, *which in fact deletes everything from the current cursor position to the end of the word. An even better macro for exactly emulating the* WordStar *command is this one:*

```
<F6><Ctrl-Right Arrow><Del>
```

Clearly, the preferred approach to deleting words is a matter of taste—and of the limitations you're willing to tolerate. For example, Mr. Bennett's delete word left macro usually works, but if the cursor is in the first word of a paragraph, the macro will delete the next-to-last word in the last paragraph rather than the last word. Similarly, if the cursor is in the last word of a paragraph, the delete word right macro will delete the second word in the next paragraph rather than the first one.
—M. David Stone

PRINTER HELP

The PRINTER.TST and PRINTER2.TST files on the *WordPerfect* Learning disk give you a good deal of information about your printer's capabilities. However, though completely undocumented, *WordPerfect* also contains very useful summaries of the features available from most printers. This information is contained in a file called PRHELP.EXE, which is on the PRINTER2 disk of *WordPerfect* 4.2.

To access the file, place the PRINTER2 disk in your disk drive and type PRHELP from the DOS prompt. If the file is on your hard disk, change to the appropriate subdirectory or enter the full pathname.

The file is largely self-explanatory, but it includes extensive directions that can be very useful to those who want them. After examining the fonts readily available from your printer, you can write a macro to access each font. Figure 1 provides an example of such a macro.

Daniel Hirsch
Washington, D.C.

Clearly WordPerfect *itself has access to detailed information about hundreds of printers. The PRHELP program simply puts this information in a form* WordPerfect *users can grasp. I imagine I'm not the only one who didn't notice that PRHELP program on the new 4.2 PRINTER2 disk.*
—Neil J. Rubenking

RESTORING UNDERLINE

Neil J. Rubenking's *WordPerfect* macro for removing underline codes and bracketing underlined material with a single char-

```
<Ctrl-F10>          Begin macro definition
FONT2 <CR>          Name it FONT2
<Home><Home><Up>    Go to top of file
<Ctrl-F8>1          Print Format -- pitch/font
<CR>                Keep the pitch option as it is
2<CR>               Select font 2
<F7>                Exit
<Ctrl-F10>          End macro definition
```

Figure 1: *A* WordPerfect *macro for accessing a font.*

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■ POWER USER

acter (Power User, December 22, 1987) is interesting and ingenious, and helps with a practical problem. A related problem is how to go the other way and insert *WP* underline codes in place of the single character. This is necessary when a *WP* user receives an ASCII file with underscores designated by the single character.

The two macros Alt-V and Alt-W shown in Figure 2 accomplish this. Alt-V goes to the beginning of the file and calls Alt-W. Alt-W assumes that a tilde (~)—rather than the underscore character used in Rubenking's original Alt-U—is used to delimit material to be underlined. It also uses *WP*'s extended search feature in order to make searches go through headers, footers, and footnotes.

Obie G. Whichard
Falls Church, Virginia

Perfect! Use Alt-U (from the Power User column of December 22, 1987) to transform underline codes into a special character and Alt-V to restore them. But whether you use a tilde or an underscore remember that the same character must not *appear anywhere else in your document.*—Neil J. Rubenking

dBASE MULTIPLE FILE SIZER

Determining file size is easy with a single, standard database: just multiply RECSIZE()*RECCOUNT(). But *dBASE* offers no built-in function to determine the size of several such files and any associated memo (.DBT) files.

Given a dynamic group of databases (and perhaps memo files), then, how many blank, formatted floppies must be prepared in advance to make a backup? The FSIZE.PRG procedure shown in Figure 3 determines this for you, either from the dot prompt or from inside a *dBASE III* application.

To start, CREATE FSIZE.DBF, specifying two fields:

```
FNAME      C      13
FSIZE      N       8    0
```

Then, whenever you (or your application) need to know the size of file(s),

```
. DO FSIZE WITH "filename.db?"
```

where *filename* is a parameter, the name of your database(s).

FSIZE.PRG then RUNs the DOS DIR

```
PARA fils
SET TALK OFF
RUN DIR &fils | FIND "-" > temp.txt
USE fsize
SET SAFE OFF
ZAP
SET SAFE ON
APPE FROM temp.txt SDF
ERAS temp.txt
SUM fsize TO totsize
? STR(RECC(),4)+" "+fils+" files total ";
 +LTRIM(STR(totsize/1024,6,1))+"K bytes."
?? STR(totsize/360000,6,1)
?? " Blank 360K floppies needed."
```

Figure 3: *A* dBASE III *procedure that returns the size of a group of files.*

```
_Alt-V
~<Ctrl-F10>          Begin macro definition
<Alt-V>              Press Alt-V
<Home><Home><Up>     To document top
<Alt-W>              Call Alt-W
<Ctrl-F10>           End macro definition

_Alt-W
~<Ctrl-F10>          Begin macro definition
<Alt-W>              Press Alt-W
<Home><F2>~<F2>      Extended search for tilde
<BackSpace>          Delete it
<Alt-F4>             Block on
~                    Advance to next tilde
<Left>               Get the cursor out from under it
<F8>                 Underline the block
<Del>                Delete the second tilde
<Alt-W>              Call Alt-W again
<Ctrl-F10>           End macro definition
```

Figure 2: *Two macros for inserting* WordPerfect *underline codes in material delimited by tildes.*

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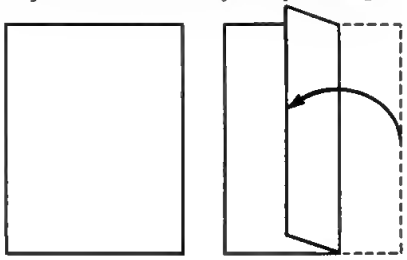

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■ POWER USER

command for files matching your parameter, piping the output through the DOS FIND to filter out extraneous lines, and redirects the information to a temporary disk file, TEMP.TXT. This text is appended into FSIZE.DBF, and each file fitting the *filename* specification becomes a single record. The field FSIZE is then SUMmed and divided by the capacity of a floppy disk to provide the answer.

You are now ready to RUN DOS's backup or whatever backup utility you might be using.

Michael Meyer
Broken Arrow, Oklahoma

Note the use of the question mark (?) placed at the end of the parameter. FSIZE.PRG's ability to accept DOS wildcards makes Mr. Meyer's procedure an especially versatile one.

For example, if you have several associated inventory databases and memo files, all of which start with the letters "inv", issue the command: DO FSIZE WITH "inv.db?". Similarly, the command: DO FSIZE WITH "inv*.*" returns the total size of the whole application, including its programs, indexes, report forms, and so on.*

To run FSIZE.PRG, you must make sure that DOS and dBASE *agree on the default drive\subdirectory, that DOS's FIND.EXE is on the DOS path, that FSIZE.DBF is on the* dBASE *path, and that you have sufficient RAM to execute the RUN command. If the capacity of your floppies is beyond 360K, modify the last two lines of the program accordingly.*

Enhancements that you might consider include introducing more precision in calculating the number of floppies required by recognizing sector size; using the DISKSPACE() function to check that the floppy is blank; or passing a second parameter specifying the COPY TO drive.

With a few extra lines and another field in FSIZE.DBF, you could use Mr. Meyer's general idea to capture the final line of DOS's DIR command and thereby determine how much space is actually available on the disk. This would be especially helpful when backing up to a hard disk or removable cartridge.

If you are using dBASE III *(not* III Plus*), the ZAP, RECC(), and LTRIM() functions are not available. For ZAP, substitute DELETE ALL followed by PACK; add the command COUNT TO TOTREC and put TOTREC in the place of RECC(); then remove the LTRIM() function, which is just window dressing.*—Brad Stark

■ If you trust *WP*'s "not modified" message and fail to save, you will lose the changes you've made.

SURPRISE

When WordPerfect *4.2 asks if you want to save your file before exiting, it sometimes displays the message "(Text was not modified)". Take this message literally! If you modify the* text *of your document at all, the message won't appear. But changing certain control codes will* not *prevent the message. To see this in action, create and save a document with some parts underlined or boldfaced. Now carefully delete only the underline or bold codes. Use "Reveal Codes" to make sure you have deleted only the [U] or [B]. Hit F7 to exit, and along with the "Save Document?" question you'll get the "(Text was not modified)" message.*

If you trust the "not modified" message and fail to save, you will lose the changes you've made in your document. This will never happen when you're creating a document or doing major editing. However, if you're just fine-tuning, always save your document regardless of the message.—Neil J. Rubenking

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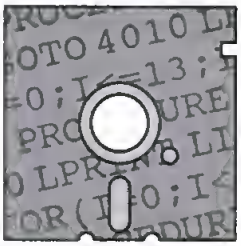
■ EDITED BY ROBERT L. HUMMEL

LANGUAGES



MENU.EXE is a highly useful C program that creates a 1-2-3–style menu, complete with highlighted choices and descriptions, that becomes a front end for other C programs.

C

1-2-3–LIKE MENUS IN C

I've developed a *1-2-3*–style menu that is small and reasonably fast. MENU.EXE displays a line of menu choices. One can navigate through the menu by pressing the Spacebar or Left and Right Arrow keys. As the menu is navigated, each selection is highlighted and a description of each choice is displayed on the line below. The user can make a selection by pressing Return when his choice is highlighted or by pressing the first letter of the selection. Pressing an invalid selection will cause the system bell to sound.

The program utilizes an array of pointers to functions, which eliminates what would otherwise be a Byzantine series of nested IF-ELSE and SWITCH statements. No matter what choice the user makes, the selection is translated into an integer offset into the array, selecting a pointer to the function to be executed.

Using this code as a template for generating a front end or menu for other programs is straightforward.

Wit Czyzynski
Berwyn, Illinois

Mr. Czyzynski's MENU program has a lot going for it. I took the liberty of modifying it to make it easier to adapt to a wider variety of circumstances. I'll explain what these changes were, their advantages, and their implications in adapting your own efforts to work with this fine program.

First, the #include directive for the header file, PcMag.h (Figure 1), was added. This header file includes a number of standard C conventions that are used quite frequently by C professionals and by other C programs shown in the Languages column. I'll refer to PcMag.h from time to time to avoid repeatedly explaining symbols that are used in more than one program. Also, use of the macros contained in PcMag.h makes C programs much easier to read.

The hierarchical nature of C's functions prompted me to take the next step. A C function can be designed as a "black box"—i.e., as a module that serves a specific purpose and whose inner workings do not need to be "known" by the caller. So the part of the code that actually generates and manages the menu was put into a separate function appropriately named menu() (see Figure 2). This makes it easier to adapt the menu generator to other programs with a minimum of side effects.

```
/* PcMag.h - Standard definitions
for PC megezine C programs  */

#ifndef TRUE
#define TRUE 1
#endif

#ifndef FALSE
#define FALSE 0
#endif

#ifndef NULL
#define NULL 0
#endif

#ifndef ERROR
#define ERROR -1
#endif

/* End of PcMag.h */
```

Figure 1: *PcMag.h is the header file for use with MENU.C (see Figure 2). It includes a number of standard C conventions. Future programs in the Languages column will sometimes refer to this file.*

Next, the lists of menu items, descriptions, and functions were placed in a single table (in this case an array of structures), with the last item set to NULL. Table-based command sets are easier to modify, and the program has to "know" very little (or nothing at all) about the contents of the table. In fact, the menu() function only makes the following assumptions about the table:

- *it has been properly initialized prior to menu() being called*
- *the last entry in the table is always a NULL entry*
- *the second character of the item name (offset 1 in the name) is always the first letter of the name*
- *the next-to-last entry points to and describes the Exit routine.*

By working within these assumptions, you will be able to modify the table easily.

Using a table-driven approach has other advantages. For instance, it would be relatively easy to modify the initialization routine, initialize(), to read the menu entries from a disk file. This would be convenient when writing a front-end or DOS shell, which could be modified without recompiling the source code. Making this change would require choosing a syntax for the disk file entries, adding a routine to the initialization code to read them, and replacing the innards of the Run() function with a call to the spawn() library routine

(or one of its variants) to execute another program. This is, in fact, the purpose of the Run() function: instead of calling a pointer to a function in the table, it could run a program whose name and arguments would be pointed to by a member of the table.

FURTHER FUNCTIONS *The initialize() function sets up a small array of characters that contains the first letter of each menu item. The array members are examined at the appropriate time to see if a matching keystroke has been pressed. This scheme assumes, however, that there are no duplicates among the menu items, so menu item names should be chosen with care. Duplicate item names are only a problem if the user selects the first letter of the item; the Spacebar and arrow keys will still navigate to the appropriate choice. In addition, initialize() passes back a count of the total array choices to menu() so it will "know" how many menu selections are available.*

Mr. Czyzynski cleverly used a far pointer to the screen buffer to access the screen directly. The get_screen_mode() routine was added to detect whether the program was running on a monochrome or color board and set this pointer to the appropriate screen buffer address. I also added a 4,000-byte array (appropriately called old_screen) in which the original screen is saved before any changes are made. This screen is then restored upon exit from menu(). To improve the program, a function could be added to detect video vertical retrace prior to screen writes, preventing

```
/* menu.c */

#include<stdio.h>
#include<bios.h>
#include<string.h>
#include"PcMag.h"

/* screen colors:
 *  NORMAL_VID value for ordinary characters,
 *  HIGHLITE for reverse
 */

#define NORMAL_VID      0x1700      /* white text, blue field    */
#define HIGHLITE_VID    0x7000      /* black text, white field   */

/* Ascii key definitions */

#define ENTER       13
#define SPACE       32
#define ESC         27

/* Scan key redefinitions */

#define RIGHT_ARROW 77+'x'
#define LEFT_ARROW  75+'x'

/* limitations: */

#define MAXMENUITEMS    25          /* number of menu items      */
#define NAME_ROW        2           /* row number of item name   */
#define NAME_COL        1           /* column number for name    */
#define DESCRIPTION_ROW 2           /* description row number    */
#define DESCRIPTION_COL 2           /* description column        */

/* macros to make the code more readable, don't touch these */

#define     SCREEN_SIZE         2000        /* screen size @ 2000 words  */
#define     ring_bell()         putch(7)    /* bell-ringing macro        */
#define     VIDEO_INT           0x10        /* BIOS video interrupt      */
#define     SET_CURSOR_SIZE     0x01        /* Int 10 function 1         */
#define     SET_CURSOR_POS      0x02        /* Int 10 function 2         */
#define     READ_CURSOR         0x03        /* Int 10 function 3         */
#define     GET_VID_MODE        0x0F        /* Int 10 function F         */
#define     MONO_MODE           7           /* monochrome video mode #   */
#define     MONO_SCREEN         0xb0000000  /* address of mono screen    */
#define     COLOR_SCREEN        0xb8000000  /* address of color screen   */
#define     CURSOR_SAVE         0           /* macro for cursor save     */
#define     CURSOR_RESTORE      1           /* macro for cursor store    */

/* global objects: */

int far *screen;                            /* pointer to screen buffer  */
int old_screen[SCREEN_SIZE];                /* store old screen here     */

/* list of function declarations for cue_functions */

int    addf(), subf(), mulf(), divf(), exitf();

/* array of structures with names, descriptions and function pointers */

struct _cue
{
    char    *cue_name;                      /* name to be displayed      */
    char    *cue_description;               /* description               */
    int     (*cue_function)();              /* function to be called     */
}
cue[MAXMENUITEMS] =
{
/* --1234567890--------1234567890123456789013-----for alignment */

    { "Add ",           "Explain addition       ",      addf,
    { "Subtract ",      "Discuss subtraction    ",      subf,
    { "Multiply ",      "Portray multiplication",       mulf,
    { "Divide ",        "Characterize division ",       divf,
    { "Exit ",          "Exit to system         ",      exitf,

        /* you can add more items here in the same fashion -
         * up to MAXMENUITEMS total
         */
    NULL,NULL,NULL
};


/* functions */

/* cls()
 * clears the screen by writing blanks to screen buffer
 */
cls()
{
    int pos=0;

    while(pos < SCREEN_SIZE)                    /* for each word in screen  */
        *(screen + pos++) = NORMAL_VID;         /* set it to NORMAL_VID     */
}

/* print()
 * prints a null-terminated string at row,col with attributes
 * returns next available column
 */
print(str, row, col, att)
char *str;
int row, col, att;
{
    while(*str)
        *(screen+row*80+col++) = att + *str++;
        return (col);
}

/* four test functions */
addf()
{
    cls();
    print("In Add, press a key for menu",2,1,HIGHLITE_VID);
    getch();
}
subf()
{
    cls();
    print("In Subtract, press a key for menu",2,1,HIGHLITE_VID);
    getch();
}

mulf()
{
    cls();
    print("In Multiply, press a key for menu",2,1,HIGHLITE_VID);
    getch();
}

divf()
{
    cls();
    print("In Divide, press a key for menu",2,1,HIGHLITE_VID);
    getch();
}

exitf()
{
    int    i;

    for( i = 0; i < SCREEN_SIZE; i++)           /* restore original screen */
        *(screen+i) = old_screen[i];

    cursor(CURSOR_RESTORE);                     /* reset cursor size/posit.*/
}


/* Run()
 * runs the appropriate test function at cue[itemnumber].cue_function.
 * This could be modified to use spawn() to run other programs.
 */
```

(continues)

Figure 2: *MENU.C uses a callable menu() function to build 1-2-3–style menus.*

the "snow" on old CGA adapters.

Another function, cursor(), was added to save the cursor position and size, turn the cursor "off" while the menu is being run, and restore the cursor upon exiting menu(). Assuming you replace the dummy functions here with your own routines, you'll want to turn the cursor back "on" when executing them, via cursor (CURSOR_RESTORE).

Several minor cosmetic changes made the program generally easier to maintain. A number of constants were rewritten as macros for readability and easier modification. Each valid keystroke was replaced by a macro identifier such as ENTER and SPACE. The ESC key macro was added to follow the convention that the Esc key should always exit to the previous level of a program or series of menus.

PROGRAM OVERVIEW *To help get an overview of the program, it's easiest to read the listing from the bottom to the top. The call to menu() is in main(), but it could be called from anywhere. Menu() performs some initialization: setting up and saving the screen and cursor. Then it clears the screen and repeatedly loops until the Exit routine, exitf(), is called.*

For each loop it prints the menu items, highlighting the current selection as it does so. Next it prints the description of the highlighted selection. Then it waits for a user keystroke.

The standard library routine getch() ordinarily returns the ASCII code for the key pressed, but it returns 0 if the key pressed has no ASCII correspondent. When this

```
Run(itemnumber)
int        itemnumber;
{
    return (cue[itemnumber].cue_function)())
}

/* cursor() * cursor operations: saves the current cursor size and position in
 * the station, or restores the cursor size and position previously
 * saved.
 */
cursor(op)
{
    union REGS r;
    static int oldcurrow,oldcurcol,oldcurstart,oldcurend;

    if(op)                                  /* restore cursor           */
    {
        r.h.ah = SET_CURSOR_POS;            /* cursor position function */
        r.h.dh = oldcurrow;                 /* set the row              */
        r.h.dl = oldcurcol;                 /* set the column           */
        r.h.bh = 0;                         /* for video page 0         */
        int86(VIDEO_INT,&r,&r);             /* call the bios            */
        r.h.ah = SET_CURSOR_SIZE;           /* cursor size function     */
        r.h.ch = oldcurstart;               /* set the start            */
        r.h.cl = oldcurend;                 /* set the end              */
        r.h.bh = 0;                         /* for video page 0         */
        int86(VIDEO_INT,&r,&r);             /* call the bios            */
    }
    else                                    /* save the cursor          */
    {
        r.h.ah = READ_CURSOR;               /* cursor read function     */
        r.h.bh = 0;                         /* page 0                   */
        int86(VIDEO_INT,&r,&r);             /* call the bios            */
        oldcurrow = r.h.dh;                 /* save the cursor row      */
        oldcurcol = r.h.dl = 0;             /* save the cursor column   */
        oldcurstart = r.h.ch;               /* save the cursor start    */
        oldcurend = r.h.cl;                 /* save the cursor end      */
        r.h.ah = SET_CURSOR_SIZE;           /* cursor size function     */
        r.h.ch = 0x20;                      /* set bit 5 to hide cursor */
        int86(VIDEO_INT,&r,&r);             /* call the bios            */
    }
}

/* initialize()
 * initializes the initials array, sets number of choices found, and
 * saves the screen buffer in the old_screen array
 */
initialize(choices,initials)
int     *choices;
char        *initials;
{
    int         i;
    get_screen_mode();                          /* set screen pointer   */

                                                /* initializes the initials */
    for( i = 0; cue[i].cue_name && i < MAXMENUITEMS; i++)
        initials[i] = tolower(cue[i].cue_name[i]);
    initials[i] = NULL;
    *choices = i;
                                                /* save old screen */
    for( i = 0; i < SCREEN_SIZE; i++)
        old_screen[i] = *(screen+i);
}

/* get_screen_mode()
 * returns the current screen mode in AL, and sets the screen pointer
 * to the appropriate video buffer address.
 */
get_screen_mode()
{
    union REGS r;

    r.h.ah = GET_VID_MODE;                  /* get video mode function  */
    int86(VIDEO_INT,&r,&r);                 /* call the bios            */
                                            /* set screen pointer       */
    screen = (int far *)((r.h.al == MONO_MODE) ? MONO_SCREEN : COLOR_SCREEN);
}

/* menu()

 * main menu creation function, callable from anywhere in a progrem.
 *  Performs the following tasks:
 *      1. saves the current screen and cursor
 *         2. clears the screen
 *         3. loops until the exit function is called through the following:
 *          1. prints the MENU items (highlights current selection)
 *             2. prints the description of the highlighted selection
 *             3. gets a key from the user (adjusts for non-ascii keys)
 *             4. takes the appropriate actions for <ENTER>, <SPACE>,
 *                <LEFT-ARROW>, <RIGHT-ARROW>, <ESC>, or the first
 *                letter of the menu item.
 *     Assumes last item is exit item and returns when that is executed.
 */
menu()
{
    static int mark = 0;
    int col, i, key, choices;
    char *match, initials[MAXMENUITEMS];

    initialize(&choices,initials)           /* initialize & save screen */

    cursor(CURSOR_SAVE);                    /* save the cursor          */
    cls();                                  /* clear the screen         */

    while(TRUE)                             /* main loop                */
    {
        col = NAME_COL;

/* print the names and highlight the current selection        */

        for( i = 0; i < choices; i++)
            col =   print(cue[i].cue_name, NAME_ROW, col,
                    (mark == i) ? HIGHLITE_VID : NORMAL_VID);
                                            /* print description        */

print(cue[mark].cue_description, DESCRIPTION_ROW, DESCRIPTION_COL, NORMAL_VID);

        if(!(key = tolower(getch())))       /* get key, and lowercase   */
            key = (getch() + 'a');          /* Not Ascii? get scan code */

        switch(key)                         /* which key was pressed?   */
        {
            case ENTER:                     /* if ENTER                 */
                Run(mark);                  /* run function at mark     */
                break;

            case RIGHT_ARROW:               /* if RIGHT_ARROW/SPACE bar */
            case SPACE:
                mark = ((mark+i) % choices); /* move to next choice     */
                break;

            case LEFT_ARROW:                /* if LEFT_ARROW            */
                                            /* move to previous choice  */
                mark = ((mark+choices-1) % choices);
                 break;

            case ESC:                       /* if ESC                   */
                return Run(choices-1);      /* select last choice (exit)*/
                break;

            default:                        /* if initials match        */
                if(match = strchr(initials,key))
                {
                    mark = (match-initials);
                    Run(match-initials);
                }
                else
                    ring_bell();            /* bad choice, ring the bell*/
                break;
        }
    }
}

main()                                      /* main program             */
{
    menu();                                 /* called as needed         */
}

/* End of MENU.C */
```

(Figure 2 ends)

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■ LANGUAGES

happens, getch() is called a second time, since it will then return the scan code of the key pressed. The scan code is adjusted to a "safe" value that will not conflict with that of a regular ASCII key. This is accomplished by adding the ASCII code for "z" (one of the highest codes) to the key value. Note that the macros for valid scan-code-only keys are modified the same way in their macro definitions.

Next is a switch that processes the key pressed. The "mark" variable is used to mark the current user selection. Notice that for the arrow keys and Spacebar the mark is adjusted to highlight another selection when we return to the top of the loop. If Esc or Enter is pressed, the appropriate offset in the table is passed to Run().

Finally, the default case checks to see if a first-letter initial has been pressed. If a match is found in the initials array, "mark" is adjusted to highlight the entry next time through the loop, and Run() is called with the appropriate offset into the table. Failing this, the bell is rung, signaling an invalid key choice.

CUSTOMIZING MENUS *To modify MENU.C for your own programs, the following important steps should be taken:*

- *Replace the entries in the cue[] array initialization with descriptions, explanations, and functions of your own choosing. Unless you change the menu function, always precede and follow your description names with a single blank, make the next-to-last entry the exit entry, and make the last entry NULL. If you make the initialization of cue[] a part of your program itself (not preinitialized as here), do it before calling the menu() function.*
- *Replace any reference to a function in the cue[] array with your own reference.*
- *Don't replace cue[] functions with functions that require parameters. That defeats the "black box" design of menu() and would require some rewriting.*

Optionally, you may want to:

- *Change the NORMAL_VID and HIGHLIGHT_VID definitions to use different screen colors. When doing so, always change the "high" byte or the first two digits after the "x."*
- *Change the NAME_ROW, NAME_COL, DESCRIPTION_ROW, and DESCRIPTION_COL values to make the menu appear on other screen lines.*

—Richard Hale Shaw

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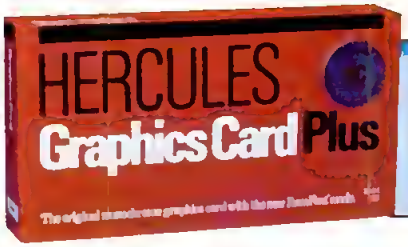

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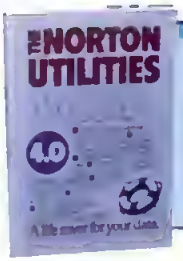

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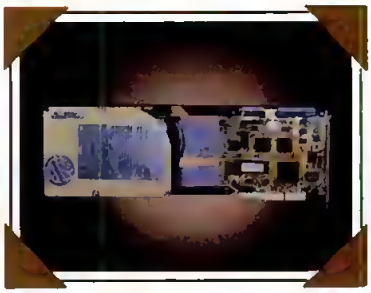

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PC TUTOR

Formatting 360K disks in a high-capacity drive; examining entries that impact the environment; understanding DOS file-naming conventions; verifying files under DOS.

EXPLORING FILE EXTENSIONS

The DOS file-naming convention, *filename.ext*, specifies that one to eight characters may be used for the *filename* portion and up to three characters may be used in what is termed the *extension*. Like most other programs, DOS attaches special significance to certain specific extensions, which it treats differently from others. In this PC Tutor, we'll examine the three file extensions important to DOS, what they mean, and how DOS interprets them. Before we delve into the file extensions themselves, however, let's review just what happens when you enter something at the command line.

Unless you're using some type of shell program or an alternate environment (such as *Microsoft Windows*, for example), after booting your computer will display what is called the command prompt. The default DOS prompt consists of the letter of the current drive, followed by a greater-than symbol. Unless you change the prompt (which DOS allows you to do), if you boot up from a floppy disk, your prompt will be A>. For a typical hard disk system, it will be C>.

DOS is a command-driven operating system, as opposed to a menu-driven operating system like that used on the Macintosh. The C> is called a command prompt because DOS is waiting for you to enter a command to tell it what to do next. What you type at the command prompt is known as the command line. To enter a command, you type its name, followed by any required arguments, and then hit the Enter key. DOS's *command interpreter*, which is named COMMAND.COM, then examines what you've entered to determine what action should be taken next.

Suppose, for example, that you type DIR on the command line and then press Enter. The first thing that happens is that the *string* (any unbroken sequence of characters is known as a *string*) "DIR" is compared against a list of valid commands built into COMMAND.COM. If a match is found, the instructions needed to perform that command are executed immediately. All activity for such *internal* commands is performed inside COMMAND. If the string you entered doesn't match any entry in the internal list, DOS then follows a set of searching rules in an attempt to locate an *external* DOS command, a program, or a batch file with that name.

THREE HAPPY ENDINGS DOS attaches special significance to the three extensions .COM, .EXE, and .BAT. A file with a .COM or .EXE extension is assumed to contain executable code that can be loaded and run by the operating system. Executable files may be application programs, utilities, or DOS external commands. CHKDSK.COM and 123.EXE are just two examples of program files. Files containing only text or data, on the other hand, are not program files and cannot be executed.

■ A file with a .COM or .EXE extension is assumed to contain executable code that can be loaded and run by the operating system.

Strictly speaking, both .COM files and .EXE files are different forms of executable files. A .COM-type program is loaded directly into memory and must be no greater than 64K in length. An .EXE program may be any size and may contain location references that have to be resolved at load time. DOS distinguishes an .EXE file from a .COM file by examining the beginning (the *header*) of the program file. If the first 2 bytes contain the characters "MZ", then the file is an .EXE file; otherwise, it is a .COM file. (Mark Zbikowski was Microsoft's primary architect for DOS, so this particular signature is not a mystery.)

A file with the .BAT extension is called a batch file. It contains one or more commands that DOS executes in sequence. For the most part, the commands appear to DOS as if you had simply typed them at the command line. The batch "language," however, has provision for some minor programming capabilities, such as looping, testing values, and jumping to labels.

FILE-SEARCHING ORDER When DOS finds that the command you entered is not one of its internal commands, it

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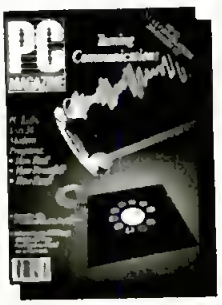

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■ PC TUTOR

searches the current directory for a disk file of that name. To see if such a file exists, a complete filename, including the extension, is built. DOS first tries appending the extension .COM to the command name and tests to see if the file exists. If found, the file is loaded and run. If not, the process is repeated, this time using the .EXE extension. Again, if found, the file is run. Finally, the .BAT extension is tried. If the file is found, it is passed to the batch interpreter for execution.

There are several important things to note about this process so far. The search for an external file is performed only when the command is not an internal command. The consequence of this is that program and batch files that have the same name as internal commands can never be executed.

The order of search for files is dependent only on the extension and is always .COM, then .EXE, then .BAT. So, if you have three files in your current directory named A.COM, A.EXE, and A.BAT, and you type A and press the Enter key, only the file A.COM will be executed.

Note, however, that you could rename a .COM to have an .EXE extension and vice versa. This is allowable because, despite the presence of a .COM or .EXE file extension, DOS still checks the first 2 bytes of the file for the .EXE signature "MZ". So you could rename A.EXE to A.COM, and it would still run properly.

The first place searched is always the current directory. If the specified filename, with either a .COM, .EXE, or .BAT extension, is not found there, then each directory specified by the PATH statement is successively searched for a file with the specified name and one of the three valid extensions. If, after searching the entire PATH, no file that matches the specification is found, COMMAND will issue the "Bad command or filename" error.—**Robert L. Hummel**

A HOSTILE ENVIRONMENT

I am having a frustrating problem with COMSPEC on my computer system. I use a dual-floppy PC with no hard disk, and several programs that I use look to drive A: when they need to reload COMMAND .COM. Removing the application disk and replacing it with the DOS disk is a pain. I thought I'd solve the problem by creating a small RAM drive to use as drive C:, copying COMMAND.COM onto it, and setting the COMSPEC variable to reflect the change. Much to my chagrin, it did no good! Listing the environment by entering the SET command with no arguments showed `COMSPEC=A:\` and `COMSPEC=C:\` entries! I have tried to erase the first by entering `SET COMSPEC=`, but cannot get rid of the COMSPEC pointing to A:. What gives?

Raphael Poliakoff
Brooklyn, New York

■ The order of search is dependent only on the extension and is always .COM, .EXE, then .BAT.

Unfortunately, Mr. Poliakoff's letter did not include a printout of the environment or a disk copy of his AUTOEXEC.BAT file, so I was unable to examine the exact entries haunting his environment. The SET command can be tricky. There are a few things about the environment and the SET command that bear explaining.

The format for the SET command is

```
SET [var]=[string]
```

When you press the Enter key at the end of this command, DOS scans the command line from left to right to parse out the var *and* string *arguments. The* var *variable is defined as the entire string of characters that begins with the first non-white-space character following the SET command and ends with the character immediately preceding the equals symbol (=). All alphabetic characters are capitalized, but otherwise no changes are made. Thus, the following two strings are* not *equivalent:*

```
SET COMSPEC=A:\
SET COMSPEC =A:\
```

In the first case, var *is "COMSPEC". But in the second,* var *is "COMSPEC ", where the trailing space is included as part of the variable name.*

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■ PC TUTOR

The string *argument is defined as simply the remainder of the command line, that is, all characters entered after the equals symbol, excluding the <Enter> used to execute the command. Note that unlike* var, *the characters in* string *are not converted to uppercase. Again, unintentional spaces can cause problems for the unwary. An unsophisticated program, for example, expecting to find the string*

```
COMSPEC=C:\
```

might fail if given

```
COMSPEC= C:\
```

So, if problems arise using what seem to be identical environment strings, examine the entries at least as closely and literally as DOS does.

FINAL FORMAT FORUM

Don't throw away those 360K diskettes that you thought you couldn't format in a high-capacity drive (PC Tutor, February 29, 1988). Like the dealer who sold you your AT, I do it all the time. And I'm not winking! Just use the switch provided with the FORMAT command to specify that combination. The syntax is

```
FORMAT A: /4
```

The DOS manual cautions that you may have trouble reading and writing such diskettes in a drive intended for 360K floppies, but mine have all worked fine.

Donald R. Wilder
Rochester, New York

In summary, to format a diskette that will have 1.2MB of storage space when using a 1.2MB drive, you must use media rated for high capacity. If you attempt to format 360K diskettes to hold 1.2MB, expect the format program to mark a large number of bytes as unavailable. To format a diskette rated for 360K to a capacity of 360K using a 1.2MB drive, you must use the /4 option to FORMAT, as Mr. Wilder notes.

Because of mechanical differences in the design of the drives, 360K diskettes formatted or written using a 1.2MB drive may subsequently be unreadable in a standard 360K drive.

VERIFYING WITH COPY

Is the /V (verify) option for the DOS COPY command equivalent to turning the VERIFY switch ON, or does it involve actual file comparison?

Victor G. Alter
Buffalo, New York

The /V parameter, when added to the end of a COPY command, causes DOS to act in the same manner as if the VERIFY ON command had been previously issued. Keep in mind that if VERIFY is turned on with VERIFY ON, it remains on until turned off. Using the /V parameter affects operation only while the COPY command is running.

The /V verify is subject to the same limitations as the VERIFY command (described in PC Tutor, February 29, 1988). Verifying a file under DOS does not involve a comparison of the original data with the duplicate data; it merely ensures that an attempt to read the duplicate data does not fail.

To convince yourself of this, copy an existing file to the NUL device with the /V switch or VERIFY on, thus:

```
COPY COMMAND.COM NUL /V
```

Since any data sent to NUL is discarded, no copy exists at any time with which to compare the original data. Despite this, the COPY command will report no errors.

ASK THE PC TUTOR

The PC Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To see your questions answered here, drop a line to PC Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016. We're sorry, but we cannot answer questions personally. PC

■ Verifying a file under DOS does not involve a comparison of the original data with its duplicate.

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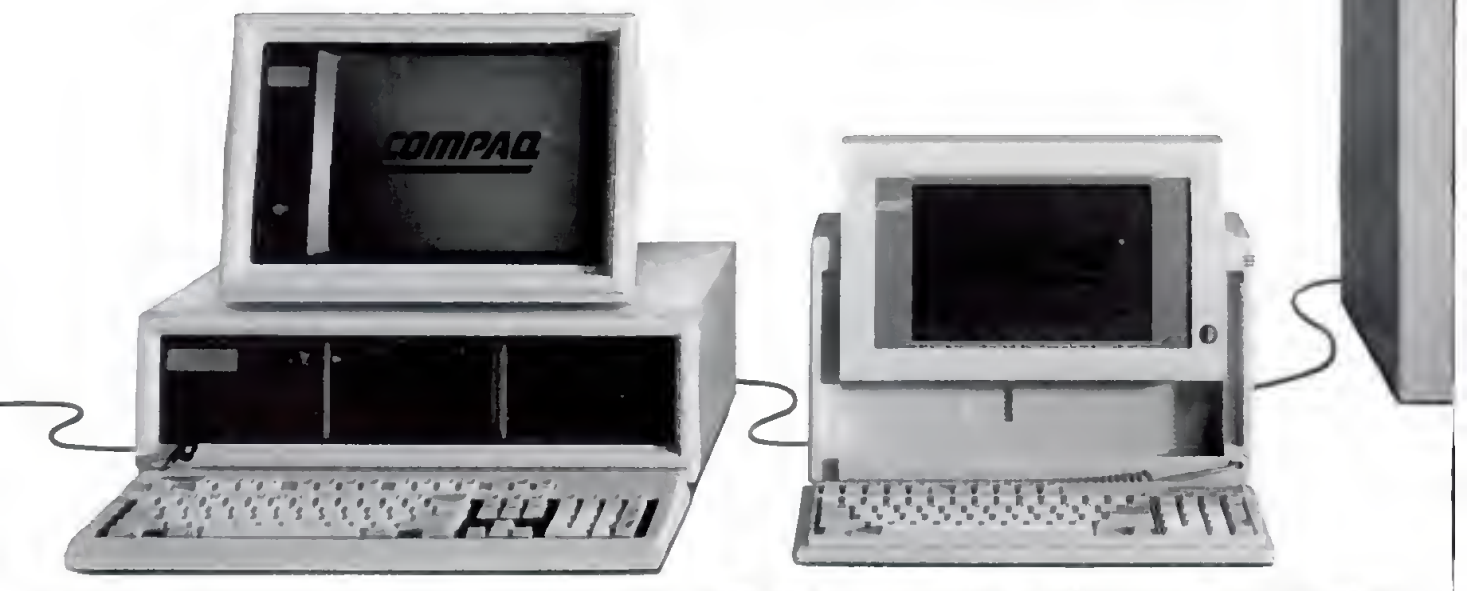

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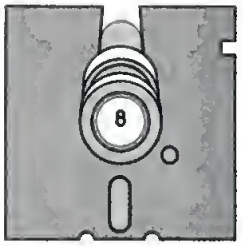
CIRCLE 356 ON READER SERVICE CARD

■ FRANK J. DERFLER, JR.

CONNECTIVITY CLINIC



A program to disable Ctrl-PrtSc; using the Novell Login script to determine the graphics card type; producing a usage log with SFT NetWare 2.1.

NOVELL IN DISTANT LANS

When we initially try to start our Novell network in the morning, it has difficulty reading the network configuration file. After two or three warm boots, the network is finally able to read the configuration file. Then the network starts giving "read error" messages while mounting the server volumes. Initially, there are about ten error messages for each volume mount, but the number of errors keeps reducing each time I reboot the system. Ultimately, the network loads successfully and works fine all through the day.

My maintenance engineer thinks we have a temperature-related problem. I tried keeping the machine on for a while in the morning and raising the temperature of the room, but this did not eliminate the problem. I suspect the battery that keeps the computer configuration is responsible, but I would like your comments.

Syed Atta Abbas
Quetta, Pakistan

The problems you describe do not fit the picture of a weak battery for CMOS configuration memory. I think instead that you have either a temperature-sensitive integrated circuit in the hard disk controller board or a mechanical problem in the hard disk drive. My suggestion is to exchange the hard disk controller with one from an identical machine and see if the problem goes away.

My only other advice is to prepare for a hard disk failure; do frequent backups to tape or floppy disk. Do any readers have other ideas?

STOP THAT PRINT SCREEN!

The anti Ctrl-Alt-Del program, NOBOOT, published in the User-to-User column (*PC Magazine*, November 10, 1987), is handy for preventing students from doing a warm boot on their terminals in our university's Orchid network.

We recently had a problem with students using Crtl-PrtSc on our network. The manual of a software package told students to enter Ctrl-PrtSc, but this had disastrous effects for our network print sharing—once a person within a print-sharing block entered Ctrl-PrtSc, the rest of the students were locked out.

I solved the problem by using the DOS ANSI.SYS console driver to disable the Ctrl-PrtSc key combination; if a student should hit Crtl-PrtSc, it would have no effect. ANSI.SYS provides an escape sequence for redefining most keys. By taking advantage of this function, I was able to disable the Ctrl-PrtSc.

I have included an assembly language program, NOPRTSCR.ASM (see Figure 1), which uses Int 21h, function 9h, to send the escape sequence to the ANSI .SYS device driver, which then does the work of redefining the input.

The working part of this function is

```
<esc>[0;114;"error msg";13p
```

where <esc> is decimal 27, octal 33, or hex 1B and "error msg" is some message displayed on the screen (in DOS) when Ctrl-PrtSc is entered. The function works by redefining key 114 (Ctrl-PrtSc) to the string within quotes and then entering a

```
title Anti CTRL-PRINTSCREEN
code_seg  segment  para  public 'code'
          assume cs:code_seg, ds:code_seg, es:code_seg, ss:code_seg
          org  100h
start:    jmp  screen

message   db   27,'[33;44;1m',27,'[2J'  ;ANSI.SYS color & clear screen
          db   'CONTROL-PRINT SCREEN IS DISABLED!',13,10
          db   27,'[0;114;"<Ctrl><PrtSc> Not Allowed !!";13p$'

screen    proc near

          mov  dx,offset message
          mov  ah,09h
          int  21h
          ret

screen    endp

code_seg  ends
          end  start
```

Figure 1: *NOPRTSCR.ASM is an assembly language program that uses ANSI.SYS to disable the Ctrl-PrtSc combination.*

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■ CONNECTIVITY CLINIC

■ Use the physical station number to determine which video driver the workstation will read.

carriage return. DOS interprets the string as a name of a file, and if it does not exist, an additional "Bad Command or File Name" error will be issued.

David H. Lipman
Trenton State College
Trenton, New Jersey

Thanks, Mr. Lipman, for your solution to a problem with annoying consequences. The best thing about it—it works.

WORKSTATION PARAMETERS

An item in the December 22 issue's Connectivity Clinic caught my eye. A reader wrote a BASIC program that uses existing commands in the Novell Login script to determine the type of graphics card used in a workstation and to set a search drive on a Novell network for an appropriate *Lotus 1-2-3* screen driver. There is an easier way to do this than using the commands in the Novell Login script.

You can use the physical station number to determine which video driver the workstation will read. Since the physical station number is unique to the network card, you can include a series of "if" statements first to determine which workstation a user is logging in from and then to specify the correct search drive.

In the Login script, you enter

```
IF P_STATION = "000000000010" THEN MAP
S2:=SYS:PROGRAM\LOTUS\MNO
IF P_STATION = "000000000011" THEN MAP
S2:=SYS:PROGRAM\LOTUS\CPQ
```

The number returned by P_Station is 12 hex characters long, so you need the leading zeros. Of course, you have to set these statements up with the appropriate station ID number, correlate the ID number with the video cards in that station, and MAP to the right video driver.

If you have a lot of workstations, you

can shorten the Login script by giving all workstations with the same kinds of video adapters network interface cards within a range of ID numbers. You can then use greater than and less than to set a range of adapter numbers. The text *is*

```
IF P_STATION > "000000000010"
AND P_STATION < "000000000020"
THEN MAP
S2:=SYS:PROGRAM\LOTUS\MNO
```

Tim Deardeuff
Provo, Utah

Your hint makes life easier for network users, but it gives the administrator more details to track. Knowing the ID of the interface card in each machine is a valuable security tool. People intent on industrial espionage can get IDs and passwords, but spoofing an interface card ID is difficult.

■ Knowing the ID of the interface card in each machine is a valuable security tool.

Use Mr. Deardeuff's out-of-range technique to write information to a special file you create. If data is in this file, it will alert you to entry by known user names using unrecognized IDs. Under NetWare, *Version 2.1, you can lock out users with unrecognized IDs who attempt to use the network. This technique proves again why a network administrator should record every piece of information about every workstation. Cross-referencing interface card IDs with types of graphics adapters is easier if you have the data beforehand.*

Some of Mr. Deardeuff's suggestions involve a lot of card juggling in an installed system, but if you are doing a new installation, it would be worth the effort.

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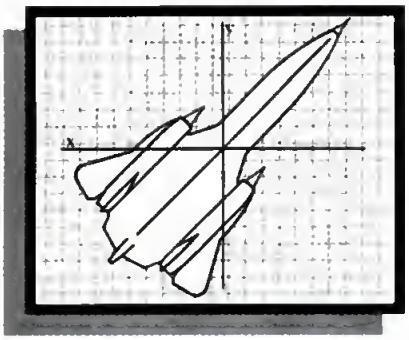

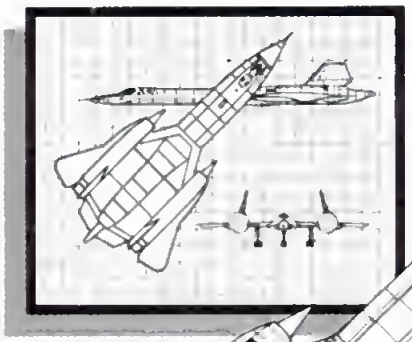

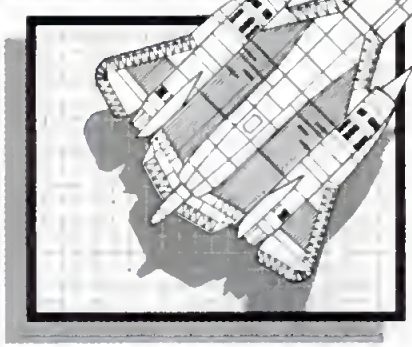

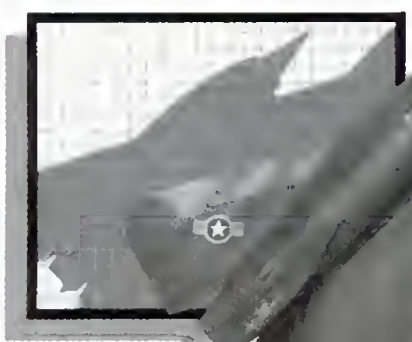

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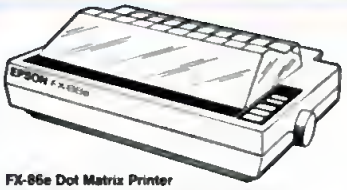

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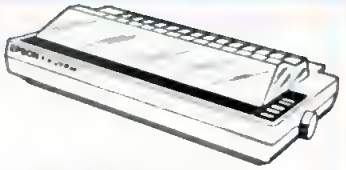

FX-286e Dot Matrix Printer

- Prints 240 characters per second printhead speed in draft mode (Elite 12 CPI)
- 48 characters per second printhead speed in Near Letter Quality mode (Elite 12 CPI)
- Exclusive SelecType feature puts Draft, Roman and Sans Serif mode selection at your fingertips
- Automatic Sheet Load feeds and positions single sheets of paper for printing
- 8K internal buffer stores and prints up to four pages of data while allowing uninterrupted use of your computer
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- Bidirectional text printing provides maximum throughput
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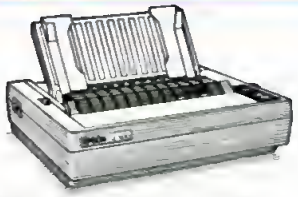

Epson's LQ-500 is a high-resolution, Letter Quality computer printer with outstanding performance features and remarkable value.

- Epson's 24-pin, dot-matrix technology creates true letter quality characters and high-resolution graphics
- Prints 180 characters per second (CPS) in draft mode, 60 CPS in letter quality (12 CPI)
- Automatic single sheet loading, standard pull tractor and friction feed for versatile paper handling
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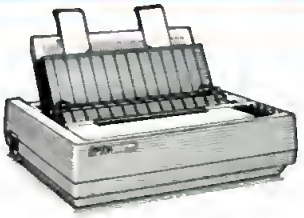
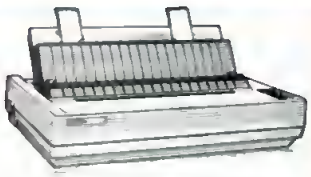


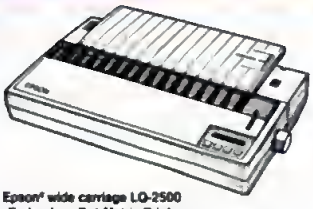
The standard width LQ-850 is a high-resolution, Letter Quality computer printer with outstanding performance features.

- Epson's 24-pin, dot-matrix technology creates true letter quality characters
- SmartPark ™ Epson's unique paper handling feature, lets you change from fanfold paper to single cut sheet paper or envelopes without removing the tractor hardware or paper
- 264 Characters per second in the high-speed draft mode delivers outstanding productivity
- 88 Characters per second in Letter Quality mode for enhanced, high-resolution characters
- In draft mode or letter quality mode, the LQ-850 runs at a surprisingly quiet 55 dB noise level
- Exclusive SelecType front control panel offers quick, easy selection of popular typestyles, fonts and pitch
- The LQ-850 is backed by Epson's one year limited warranty



The wide carriage LQ-1050 is a high-resolution, Letter Quality computer printer with outstanding performance features.

- Epson's 24-pin, dot-matrix technology creates true letter quality characters
- SmartPark,™ Epson's unique paper handling feature, lets you change from fanfold paper to single cut sheet paper or envelopes without removing the tractor hardware or paper
- 264 Characters per second in the high-speed draft mode delivers outstanding productivity
- 88 Characters per second in Letter Quality mode for enhanced, high-resolution characters
- In draft mode or letter quality mode, the LQ-1050 runs at a surprisingly quiet 55 dB noise level
- Exclusive SelecType front control panel offers quick, easy selection of popular typestyles, fonts and pitch
- The LQ-1050 is backed by Epson's one year limited warranty



The Epson® wide carriage LQ-2500 High-Technology Dot-Matrix Printer

- Prints ultra-high speed drafts, letter-quality documents and sharp, detailed graphics.
- Prints 324 characters per second printhead speed in draft mode (Elite 12 CPI), 405 characters (Elite 15 CPI) in ultra-high speed mode
- Prints 108 characters per second printhead speed (12 CPI) in Letter Quality mode
- SelecType III front panel control with 20-character LCD displays, prompts, confirms and stores up to 14 printer functions in any of four memory cells.
- Eliminates DIP switch settings through the use of macros and stores up to four different print set-ups.
- Five resident, letter-quality fonts.
- Intelligent, logic-seeking electronics system prints bidirectionally in text and graphics for maximum throughput.
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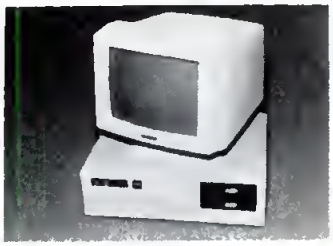

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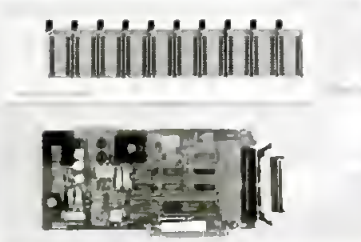

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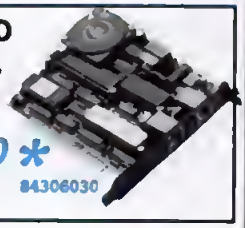

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COMING UP

LAN SOFTWARE Networking hardware may be visible and touchable, but it's the software that drives the hardware. The best networking software is invisible to users, but it's the biggest factor in determining the response time, flexibility, and practicality of a network.

With the thoroughness characteristic of *PC Magazine*'s comparative reviews, we present the results of months of testing and analysis, supervised by Frank J. Derfler, Jr., and his connectivity team. Our coverage compares 13 PC-based network operating systems, 17 workgroup productivity programs, and 8 LAN utility programs, giving readers a comprehensive picture of the categories, benefits, features, and failings of networking software.

Our report on LAN software will address specialized application products, including workgroup computing programs and utilities for network administration. We'll also bring you surprising reader survey results about the typical LAN.

In addition, we'll explore the subject of workstation control and security, an important issue in the modern office. With the ability to control and limit access to its central files, a LAN goes a long way toward solving managerial dilemmas. Our reviews of applications dedicated to serving the LAN manager will tip off readers to the ways in which LANs can be managed most effectively.

The primary functions of a local area network—file exchange, equipment sharing, and simultaneous access of data—mean increased productivity for small office groups and entire corporations alike. Whether or not any LAN applications actually sweep you off your feet, we're almost certain to convince you that they'll make your business life easier and more productive.

UTILITIES Speaking of productivity, if you need to see where the changes were made between two versions of a text or binary file, COMPARE in the Utilities column unerringly hunts them down and highlights them in a split-screen display. And see User-to-User for a quick fix for any PC that boots with NumLock on.

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HOW TO SUCCESSFULLY BUY THROUGH MAIL ORDER AND PROTECT YOUR RIGHTS

Mail order sales are governed by rules of the Federal Trade Commission (FTC) and various state laws. These guidelines are published as a service to you. Remember, the many vendors advertising in PC Magazine are eager to serve your needs.

FTC rules say:

1. The Seller must ship your order within 30 days of receiving it, unless the advertisement clearly states it'll take longer.

2. If it appears that your order will not be shipped when promised, the Seller must notify you in writing in advance of the promised date, giving a definite new date, if known, and offering you the opportunity to cancel the order with a refund or consent to a definite delayed shipping date or an indefinite delay.

3. The Seller's notice must contain a stamped self-addressed card or envelope with which you can indicate your preference. If you don't respond to this notice, the Seller may assume you agree to the delay, but must either ship or cancel your order within 30 days after the original shipping date promised or required. A prompt refund must be made when an order is cancelled.

4. Even if you've consented to an indefinite delay, you retain the right to cancel the order at any time before the item has been shipped.

5. If you choose to cancel an order, that has been paid for by check or money order, the Seller must mail you a refund within seven business days. If you cancel an order for which you paid by credit card, the seller must credit your account within one billing cycle following receipt of your request. Store credits or vouchers in place of a refund are not acceptable.

6. In the event that the item you ordered is unavailable, the Seller may not send you substitute merchandise without your express consent.

TIPS WHEN ORDERING

When ordering by mail:

State precisely what merchandise you want, specifying details such as model, make, size, component parts, etc.;

Confirm the price and expected delivery date as stated in the ad;

Indicate whether you will accept a substitute product if the item you ordered is unavailable, and, if not, that your payment should be returned;

Don't send cash, you will have no record of payment if a problem arises, and;

Keep a copy of your order and all other correspondence with the Seller. Your records should include the company's name, address and phone number; a description of the item ordered; your cancelled check or a copy of the money order; record of the date you mailed the order; and any sales slips and shipping receipts.

When ordering by phone:

Note the time and date of your conversation and the name of the person you talk with;

Make a record of your order, the price, its promised availability and the components to be expected;

Save all correspondence associated with your order, including your cancelled check or a copy of the money order, and any written confirmation sent by the Seller.

Questions you should consider asking:

Does the advertised item come with all necessary parts and accessories? Are they from the same manufacturer?

Is it available for immediate shipping?. If not, when will it be available?

Has there been an increase in the advertised price?

What warranties does the item carry? Who provides the service?

What is the Seller's return policy?

What is the Seller's refund policy?

With whom should you correspond if there is a problem?

IF YOU HAVE PROBLEMS:

1. If you have not received your order as promised or if the item is defective, immediately notify the Seller in writing referring to your order by description, price, date, as well as by account number and order number, if available. Make sure you keep a copy of the letter.

2. If you complain by telephone, send a follow-up letter to confirm what was said.

3. If you think the merchandise is defective, reread your product instructions and your warranty carefully to be sure you don't expect features or performance the product isn't designed to give. Then contact the Seller for instructions. Don't return it to the Seller until you have been instructed to do so.

4. When returning merchandise make sure you keep the shipper's receipt or packing slip; your right to be reimbursed for postal cost is determined by store policy.

5. If you have completely discussed your problem with the Seller and are still not satisfied, write to the consumer complaint agency in the Seller's state. If you paid for the merchandise by credit card, you may have rights to withhold payment under a Federal law called the Fair Credit Billing Act.

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• 8 MHZ Processing Speed • 0-16 MB RAM Available • Bios • 16Bit 8088-2 CPU • Two 360K Half/Height Floppy Drives • Multi I/O (w/Floppy Controller Clock/Calendar Parallel, Serial, & Game Port) • One 20MB Hard Drive (w/Controller) • TURBO/Normal Mode Either Software or Hardware Selectable • Eight Expansion Slots • PC/XT Compatible Keyboard
RETAIL VALUE 2499.
OUR PRICE 1395.

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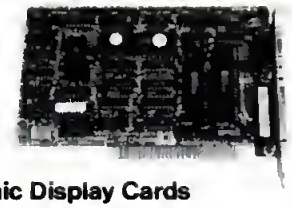
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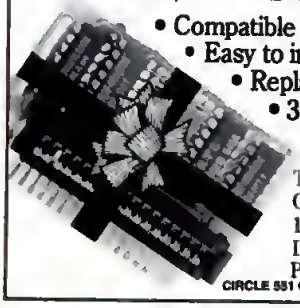

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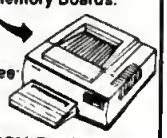

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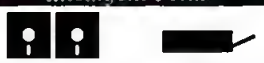

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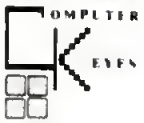

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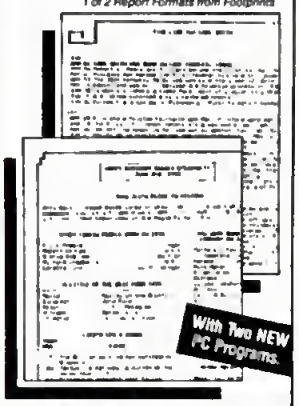

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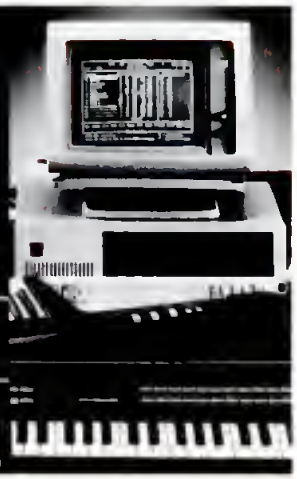

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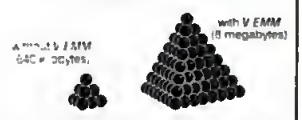

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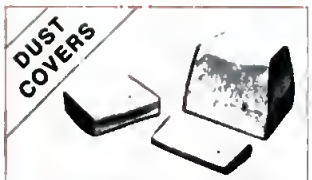

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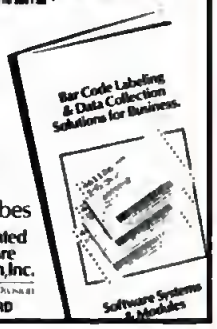

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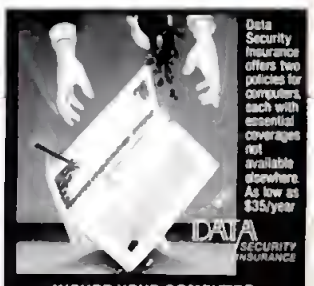

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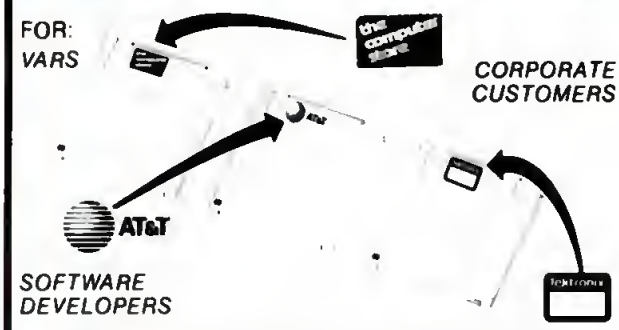

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- c. ☐ Education

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- l. ☐ 11-25
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- o. ☐ Linked to mainframe
- p. ☐ Linked to mini
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6. Does your company own
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- v. ☐ In 6 to 12 months
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Any company can take Only one can put

The moment IBM introduced the Personal System/2 family, the race was on to copy or "clone" the new technology.

Easier said than done. And here's why.

When IBM set out to make the new computers, we could have simply installed a more powerful chip into our top PC performer, as some computer companies are doing. To us, that's just pushing an older technology to its limits.

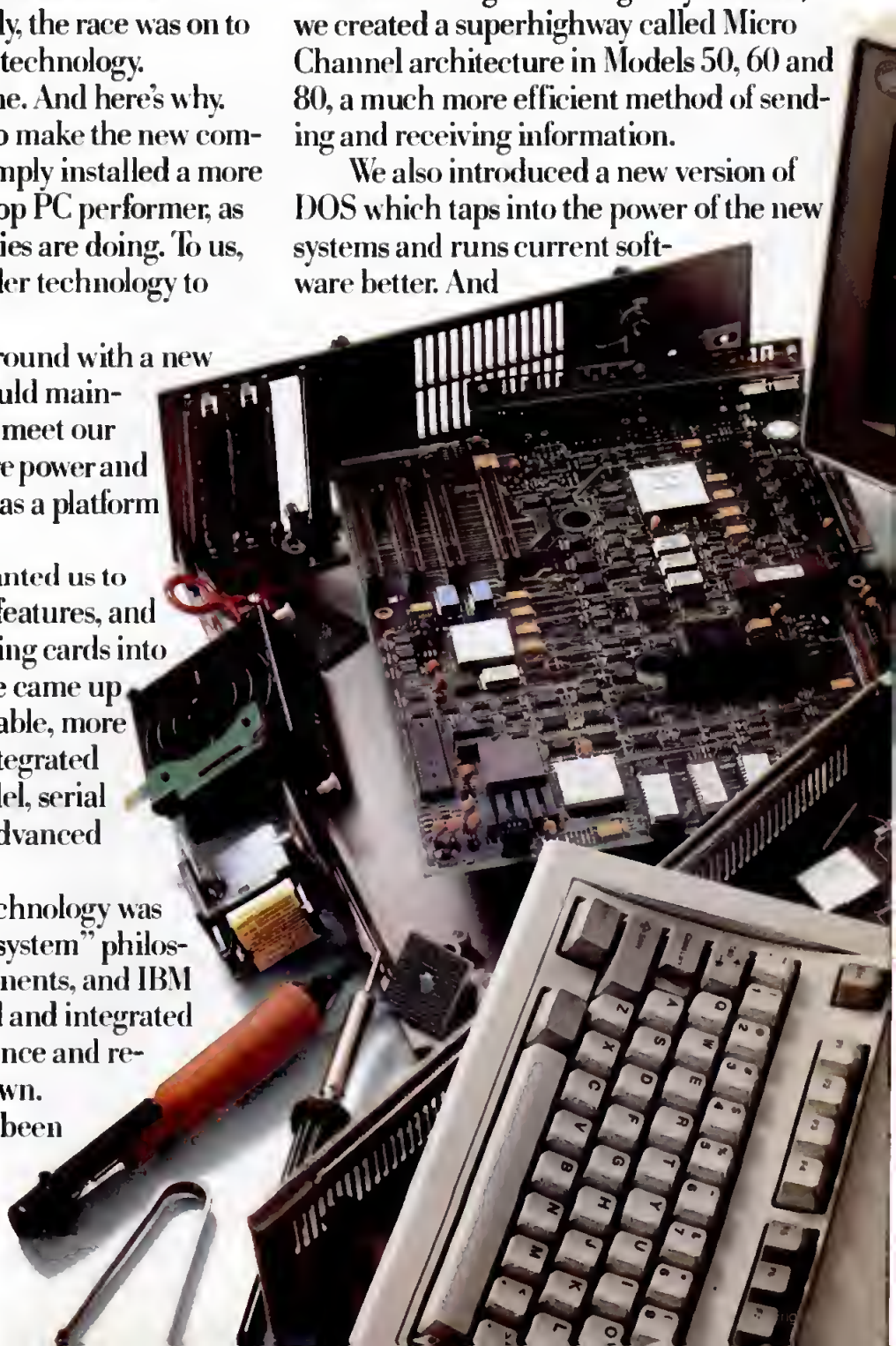
Instead, we broke ground with a new technology. One that would maintain links to earlier PCs, meet our customers' needs for more power and performance, and serve as a platform for future growth.

For instance, you wanted us to give you more standard features, and we did, but not by plugging cards into the machine. Instead, we came up with a quieter, more reliable, more compact solution—an integrated planar board with parallel, serial and mouse ports, even advanced graphics, built in.

In fact, the entire technology was developed from a "total system" philosophy—using IBM components, and IBM chips, specially designed and integrated to send overall performance and reliability up, and costs down.

We could even have been content to direct information through a traditional "single bus" highway. Instead, we created a superhighway called Micro Channel architecture in Models 50, 60 and 80, a much more efficient method of sending and receiving information.

We also introduced a new version of DOS which taps into the power of the new systems and runs current software better. And



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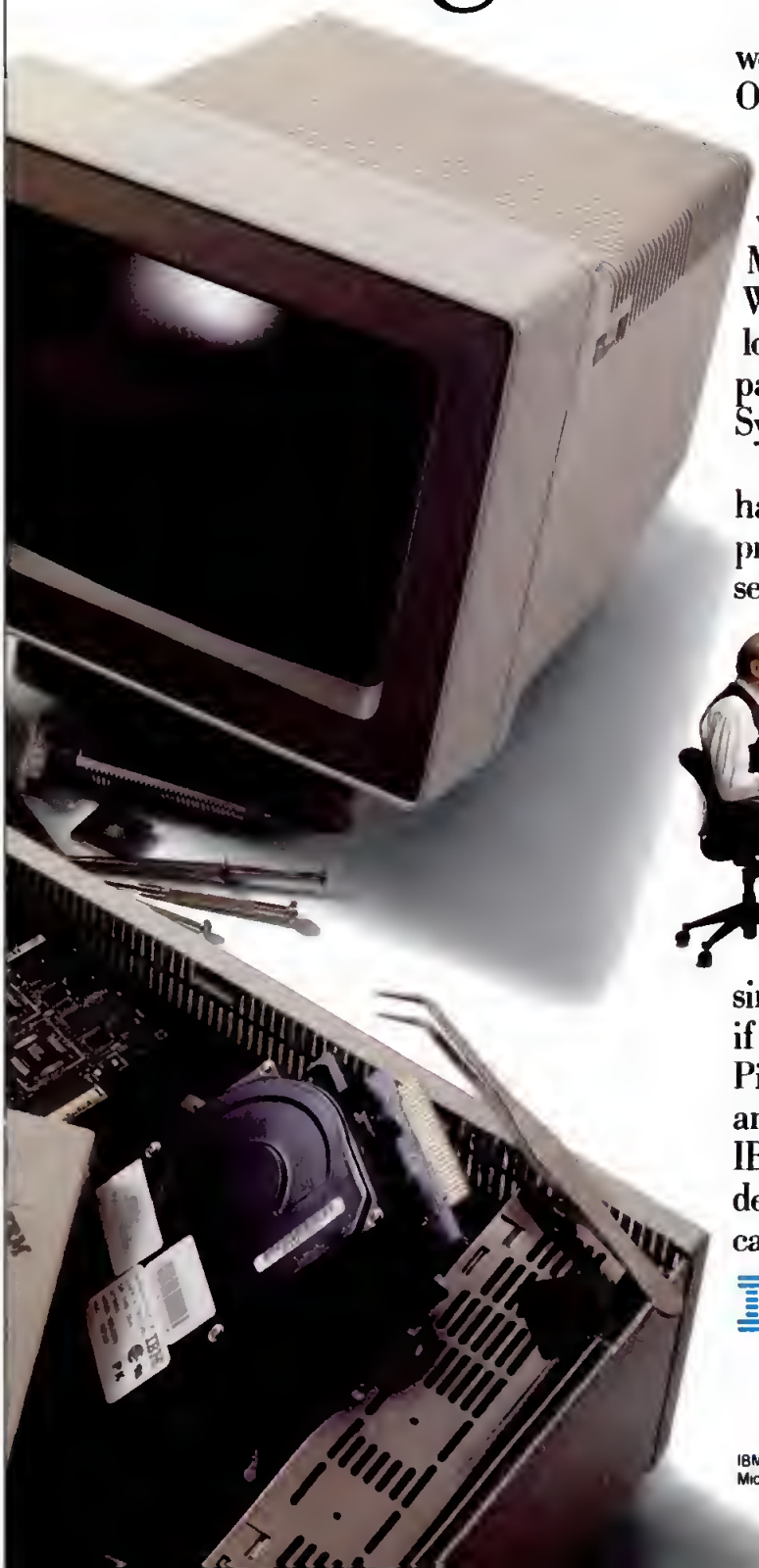
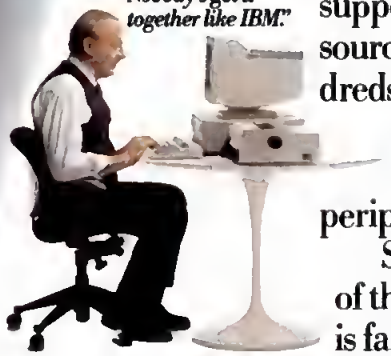


we just unveiled a new operating system, OS/2, that opens up a world of possibilities.

For starters, it's compatible with today's DOS, to protect your investment in hardware and software. It works beautifully with Micro Channel, to make multitasking easier. What's more, OS/2 establishes a consistent look for virtually all software and systems, part of a blueprint for the future we call Systems Application Architecture.

Even IBM's legendary dealer network has been improved. A special certification program gives dealers advanced training, so service and support are even stronger. In fact, support comes from many sources—right now, hundreds of outside developers are creating new cards, software and peripherals.



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So you see, the world of the Personal System/2 is far greater than any single computer or chip or component. And if you don't keep your eye on The Bigger Picture, you can just wind up with lots of bits and pieces. For more information, see your IBM Marketing Representative or authorized dealer. For the name of a dealer near you, call 1-800-447-4700.

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AFTER HOURS

Amnesia lets you get your hands on some quick cash by panhandling But beware—the smiling police officer won't let you get away with it twice in a row.

GAMES

Fighting Your Way out Of New York City

BY JENNIFER ZAINO

You'll find yourself asking many questions while playing Electronic Arts' text adventure game *Amnesia*. Questions such as "Who am I?", "What am I?", and "Why couldn't this game be less frustrating?"

You start in a hotel room, without any idea of who you are, or how you got there.

The island of Manhattan is your game board, so be prepared to bump into some of the city's most famous, and infamous, landmarks. Hints to get you going are provided in an accompanying booklet.

A subway guide and street map of Manhattan also help you make your way around.

However, the program's indexer wheel, which references cross streets to addresses along 15 New York avenues, was intentionally designed to provide wrong answers. Although *Amnesia* is keydisk copy protected, the indexer wheel serves as a somewhat bizarre and even sadistic form of backup copy protection; should you give the correct cross street to the wrong stranger, he'll kill you.

You'll have to avoid the police, who are after you for a murder you may or may not have committed while you were (or maybe weren't?) in jail in Texas. You'll also have to outwit a drawling, gun-toting Texan, break the heart of a woman who claims to be your fiancee, and rescue the fair Bette from murderous cutthroats. You won't get far without cash, so you'll have to work or beg from real-life city characters like the Hare Krishna devotee.

You've got to eat and sleep too, and this is where the game gets frustrating. Ominous warnings about your need for rest can haphazardly occur at unlikely hours, such as midmorning after a sound night's sleep, or late afternoon after a full-course meal. Ignoring these warnings, which come often enough to convince you that you may be narcoleptic, will more than likely result in your death.

There's a lot to recommend this program—I found the mystery intriguing and the writing colorful. But the frustrations I encountered made the game more fatiguing than fun, and that makes *Amnesia* hard to forgive and, yes, to forget.

List Price: *Amnesia*, $44.95. **Requires:** 128K RAM, one disk drive, DOS 1.0 to 3.1. Copy protected. Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404; (415) 571-7171.

CIRCLE **648** ON READER SERVICE CARD

REFERENCE

Congressional Toolkit: How to Give Washington a Piece of Your Mind

BY JONATHAN MATZKIN

Computers are as much a part of politics as the proverbial smoke-filled room once was. The networks use them to tell you who won before the polls even close, and party strategists look jealously at the competition's direct-mail software. And wouldn't you just love a quick peek at Ollie North's e-mail?

But it isn't just party bosses and federal functionaries who can use the PC in the political process. *Congressional Toolkit* automates the chore of writing your congressman or state legislator.

Whether you want to bombard everyone in Congress with paper, or just want to write to your senators, this program will print the letters and automatically include the inside addresses and salutations. It will also emblazon mailing labels with the appropriate addresses.

The essence of the $39 package is a database of legislators and their addresses. There is a version of *Congressional Toolkit* for the federal government; separate versions cover each of the 50 state legislatures.

Unfortunately, you can't buy a copy of the basic program and then add whichever of the databases fits your needs.

Instead, it is necessary to install *Congressional Toolkit*, in its entirety, in a separate subdirectory for each legislature. That makes life unnecessarily difficult for, say, a lobbying group that targets legislators in 25 states. Definitely a matter for Version 2.0 to address.

After you fire off a letter (up to eight pages long) on *Congressional Toolkit*'s built-in word processor, you select the legislators you want to receive your epistle.

A series of menus lets you blanket the entire legislature or just Democrats or Republicans. Name a committee, and *Congressional Toolkit* will write to all of its members.

Congressional Toolkit is a compiled *Clipper* program and is a bit slow in operation. Despite its shortcomings, it could be a real boon to those who often write their elected officials.

List Price: *Congressional Toolkit*, $39. **Requires:** 384K RAM, two disk drives, printer, DOS 2.0 or later. Not copy protected. BJ Toolkit, Alexander Ln., Croton-on-Hudson, NY 10520; (914) 271-3645.

CIRCLE **647** ON READER SERVICE CARD

Congressional Toolkit addresses letters to the congressmen of your choice. You can write to one legislator, to the entire Congress, or to a selected group.

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AFTER HOURS

ART & LEISURE

Mother Goose Comes To Life in Brilliant Color

BY DONALD B. TRIVETTE

Jack, be nimble, Jack, be quick, Jack, jump over the candlestick.

I just spent several pleasant hours trying to reunite Jack with his candle. Along the way I passed the home of a chap named Tommy Tucker who was singing for his supper; I stopped to chat with Miss Peep out in search of lost sheep; and I caught sight of Jack and Jill climbing a distant hill. Eventually I located the wayward candle and returned it to Jack, who was so grateful that he leapt over it, thereby gaining me one of the 18 points I was seeking.

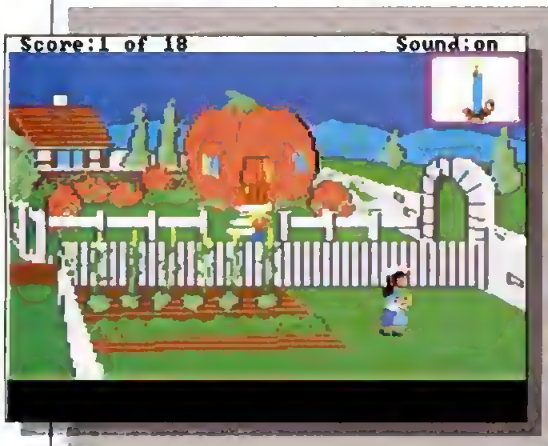
This is Sierra On-line's *Mixed-up Mother Goose*. When the game opens, you select one of eight icons to represent yourself; then, using either a joystick or the arrow keys, you stroll through the kind of stunning animation that Sierra does so well. The software, designed with children in mind, uses graphics to prompt those too young to read. For example, when you approach Bo Peep she says that she's looking for her sheep, and a picture of sheep appears in a balloon over her head. You then roam around the 46 screens of Mother-Goose-dom looking for the missing object. When you've found it—the sheep in this case—the object automatically follows you until you return it to the character who lost it. The character then acts out the rhyme. You ain't seen nothing 'til you've seen a cow jump over the moon and a dish run away with a spoon.

There are 18 rhymes in all, including a cat missing a fiddle, H. Dumpty looking for a ladder, a vacant tuffet, and a lambless Mary. The package has a colorful map of the territory, a list of all 18 rhymes, and a parents' guide to explain things like saving to disk.

This is a game for all ages, although little ones from four to ten and nostalgic adults are likely to be its biggest fans. There's no violence—only beautifully animated scenes; *Mixed-up Mother Goose* won't exercise your child's reflexes, but it will stimulate his or her imagination and problem-solving abilities. Games like this should win awards.

List Price: *Mixed-up Mother Goose*, $29.95. **Requires:** 256K RAM, graphics adapter, one disk drive, DOS 2.0 or later. Copy protected. Sierra On-line, P.O. Box 485, Coarsegold, CA 93614; (800) 344-7448.

CIRCLE **636** ON READER SERVICE CARD



In search of Jack-be-Nimble's candle, you'll pass Peter the Pumpkin Eater's house in Mixed-up Mother Goose.

Dr Shrink *tells you a lot about your friends, some of it dubious.*

PERSONAL GROWTH

Dr. Shrink Takes You On a Voyage to the Surface of the Mind

BY EDWARD MENDELSON

Neuralytic Systems' *Dr. Shrink* never pretends to be a $49.95 substitute for a psychoanalyst. The good doctor purports to analyze other people's personalities for you. It even promises to explain how to gain power over them and offers a description of their erotic fantasies. It neglects to say whether these two features are supposed to be related to each other.

Dr. Shrink produces detailed analyses, but fortunately for the friends of anyone who buys a copy, the detail is more fanciful than accurate. The program first asks you to work through a list of 50 characteristics and to decide how much you agree or disagree that the person you want to analyze is "cautious," "extroverted," "hung up," "intelligent," or "relaxed." Then it generates a seven-paragraph report on the person's public and private self, deepest loves, hates, and sex fantasies, with suggestions on how to influence that person.

Most of the revelations won't shock the average five-year-old. I asked *Dr. Shrink* about a friend of mine (call her Michelle Exemplar), and was told that Michelle's deepest hate is loud parties. Most of the analysis sounds highly arbitrary. The first time *Dr. Shrink* checked out Michelle, he said she most loves to curl up by the fireplace with a good book. But when I changed my answer to only one question—by saying that I mildly rather than strongly disagreed with the idea that Michelle was manipulative—*Dr. Shrink* rewrote half of its analysis. Suddenly Michelle didn't like the fireplace and preferred the forest and the ocean.

A few seconds with a file-peeking program shows that *Dr. Shrink* uses a 220K database of canned phrases to generate its analyses. It links these phrases using rules that have more to do with English grammar than with analytic psychology.

Dr. Shrink won't give you power over the person of your dreams. But it can liven up a rainy afternoon by giving you amazing descriptions of friends you thought you knew like the back of your hand.

List Price: *Dr. Shrink*, $49.95. **Requires:** 256K RAM, one disk drive. Not copy protected. Neuralytic Systems, 66 Bovet Rd., #390, San Mateo, CA 94402; (415) 573-9001.

CIRCLE **635** ON READER SERVICE CARD

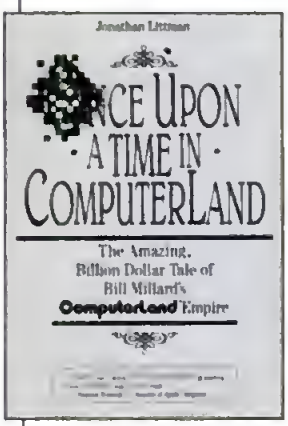
BOOK REVIEWS

From Computer Shack To ComputerLand: An Outsider's View of a PC Retailer

BY DONALD B. TRIVETTE

Just a dozen years ago, in 1976, a small company located in California sold one of the world's first personal computers. It was called the IMSAI 8080, and it featured no tape drive, no screen, no keyboard, and no software. The 30-pound box with wooden handles and a front panel consisting of switches and lights—the input and output devices—cost $439 in kit form; it had 24K of memory.

Although that particular computer was one of those dead branches that litter the personal computer family tree, the company that sold it eventually evolved into the mighty billion-dollar ComputerLand.



Once Upon a Time in ComputerLand, by Jonathan Littman, is an account of the rise and fall of Bill Millard, the founder of the ComputerLand franchise. The book revolves around Millard and the now famous $250,000 convertible note that he gave to a group of businessmen in 1976 in order to help finance ComputerLand—a note which was convertible into a 20 percent share of the company. At one point Millard could have repurchased the note for $300,000, but as ComputerLand prospered, the value of the note increased, until some estimates placed its value at several hundred million dollars. Littman chronicles in painstaking and often boring detail the seemingly endless saga of the note, which eventually caused Millard to lose control of the very company that he founded.

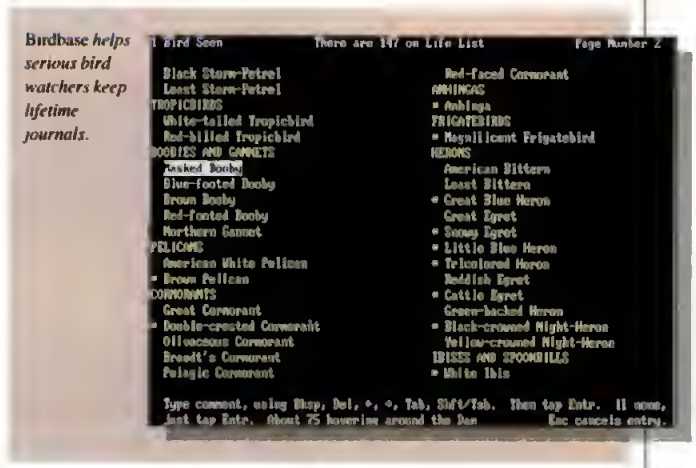
Interesting Stories

If you overlook the parts of the book dealing with high and low finance, you'll find some fascinating stories. You'll learn that ComputerLand was once Computer Shack, until Tandy threatened to sue. You'll read how a small group of ComputerLand franchisees met at the request of IBM in 1980 to preview IBM's personal computer. It was this group, according to Littman, that coined the name IBM PC and suggested several improvements, like dual disk drives.

Littman paints a fascinating picture of Millard, a man who spent more time working out the seating arrangement for business meetings than in placing a 10-million-dollar order for computers. A man who ran his billion-dollar corporation from an attic-like aerie in his palatial home, where two floors below he employed a full-time attendant to manage and catalog his wardrobe. A man who once spent the last two hours of a three-hour meeting just staring at a subordinate, Millard runs a close second to the late Howard Hughes in the eccentricity department.

List Price: *Once Upon a Time in ComputerLand*, by Jonathan Littman, $16.95. tSBN Number: 0-89586-502-5. Price Stern Sloan Inc., 360 N. La Cienega, Los Angeles, CA 90048.

CIRCLE **638** ON READER SERVICE CARD



Birdbase *helps serious bird watchers keep lifetime journals.*

HOBBIES

For Birders Only: A Sighting Journal

BY MICHAEL W. MUCHMORE

I've always meant to keep a journal recording birds I've sighted at an unexpected date or location.

I was never vain enough to keep a life list, although there is satisfaction to be gained from doing so. It's more useful to have a record of places, times, and habitats of observation than just a check by the bird's name in your field guide.

Birdbase, a new program from Santa Barbara Software Products, encourages you to record sightings scrupulously.

In *Birdbase*, there are two ways of entering and viewing names of birds you have seen. Initializing mode has you enter all birds you have spotted before using the program, without comments. After this, you enter the site and date of each outing and list the species seen on specific trips, with comments.

You can type everything but the trip location, date, and comments with single keystrokes. You can display sighting lists by range, date range, species, and other criteria. The program can store 6,000 sightings on a 360K floppy, and up to 32,500 on a hard disk directory.

Birdbase familiarizes you with the latest American Ornithologists' Union names and taxonomical ordering of the 720 species in the U.S. and Canada, which most field guides follow. Accidentals (birds seen in far-away lands) and official name changes, splits, and combinations can be added to the list.

Birdbase updates your life list and a list of previously unseen North American birds as you enter each trip sighting.

The documentation that accompanies *Birdbase*, while not splendidly typeset or bound, is straightforward and informative. It is geared toward non–power users.

A power user could obtain a species list from the AOU and enter it into a database to end up with the same features, but *Birdbase* does all that for you for $39.95.

I have lapsed in my quest for seeing new species; patiently pursuing that tweeting sound in the bush became frustrating. Now that there's *Birdbase*, I just may renew that quest.

List Price: *Birdbase*, $39.95. **Requires:** 192K RAM, two disk drives, DOS 2.0 or later. Copy protected. Santa Barbara Software Products, 1400 Dover Rd., Santa Barbara, CA 93103; (805) 963-4886.

CIRCLE **637** ON READER SERVICE CARD

LANGUAGES

Mind Travels Puts Fun Into Learning French

BY PEGGY GAVAN

Remember when you were young and the reward for eating all your vegetables was dessert? HAS Ware takes this same approach with *Mind Travels*, a French-English vocabulary quizmaster: clean up as the game dishes it out, and you get to play two video games.

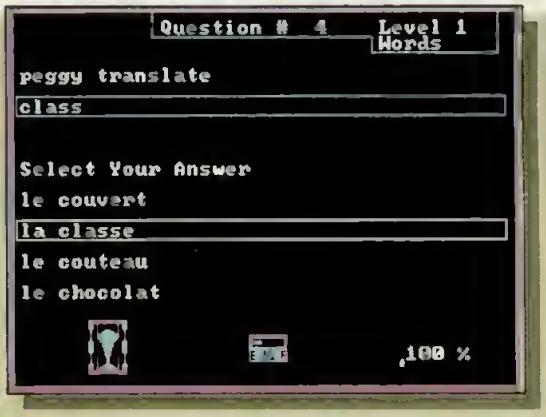
The main course of *Mind Travels* is a ten-word multiple-choice quiz. You can choose between an English-to-French or a French-to-English translation. In each session, you're challenged to select the correct equivalent to the given word or phrase out of four choices before all the sand in a graphic "hourglass" flows out. The cursor's limited movement (down only) makes answer selection a little harder than it need be, but the pressure of translating each word quickly is an exercise that can help change textbook knowledge into instinctive behavior.

There are only 960 questions in the program when you start, but there's a parent/teacher mode that lets you add or delete entire quizzes or individual words.

What separates *Mind Travels* from similar programs is an extra element of strategy that rewards fast responses. Every time you answer a question correctly, a "fuel gauge" located at the bottom of the screen moves progressively from the empty to the full position. This fuel is used later on in the game section; the more questions you answer correctly, the easier it will be to win the games.

The program also offers three levels of difficulty in which not only do the words and phrases get tougher, but the speed of the sand flowing out of the hourglass also increases.

The "dessert" portion of *Mind Travels* consists of two arcade-style games, each with five levels of difficulty. In the first game, you must maneuver a ship across the Atlantic Ocean to a harbor outside Paris without colliding with whales, running out of fuel, or washing ashore. In the second game, the object is to save the Eiffel Tower from a fire without getting struck by a bolt of lightning.



Mind Travels *encourages French vocabulary development by rewarding quick responses with extra "fuel" that will be welcome later in the game*

Although the manual states the program supports either the keyboard arrow keys or a joystick, I found it very difficult and frustrating to use the keyboard for the game: every time I played the games, I either landed in the ocean or crashed into the Eiffel Tower.

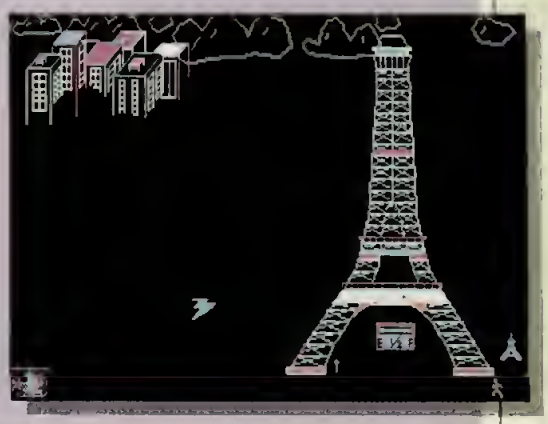
Game playing and quiz taking are best on XT-level PCs; move above 8 MHz and you'll have a hard time keeping up.

Keyboard problems aside, *Mind Travels*' bilingual approach (the manual is written in both languages) makes the program a good choice for French- or English-speaking students looking for help in learning a second language.

The fast pace of the quiz can help drum in words that are spinning around in the back of a student's head. And the optional test additions can prove to be a valuable tool for anyone teaching French.

List Price: *Mind Travels*, $39.95 (U.S.A.); $49.95 (Canada).
Requires: 256K RAM, one disk drive, DOS 2.0 or later. Not copy protected. HAS Ware, P.O. Box 315, Orleans, Ontario, Canada K1C 1S7; (613) 837-1514.

CIRCLE **649** ON READER SERVICE CARD



Part of Mind Travels' *"dessert" course: dodge lightning bolts, take off in the helicopter (bottom left), and put out a fire threatening the Eiffel Tower.*

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The difference between having power...

PC MAG

L I B R A R Y

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PC AI Magazine (comparing QuickC to Turbo C), Fall 1987, by Brian Flamig, reprinted with permission.

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Alan Holub, Columnist, Dr. Dobb's Journal, October 1987.

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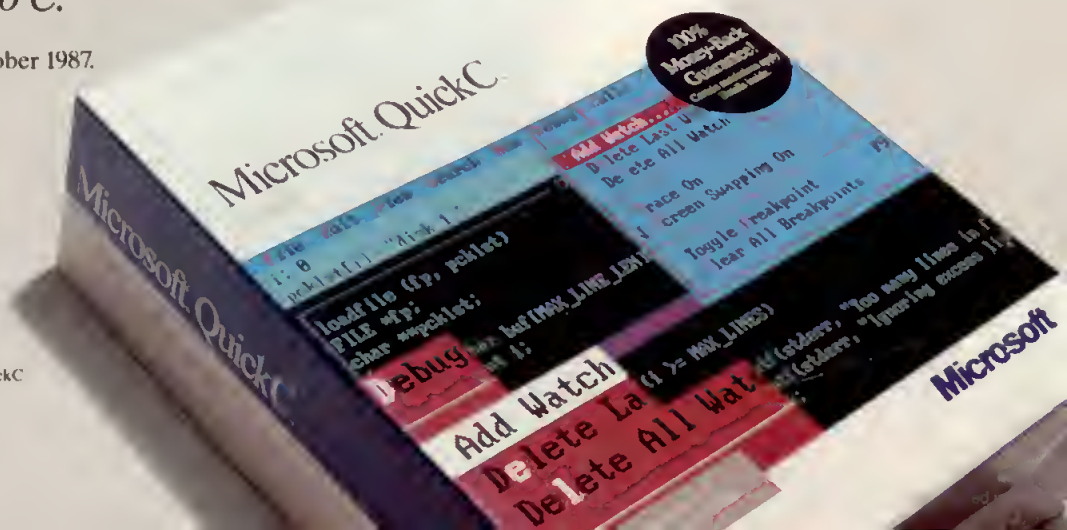

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